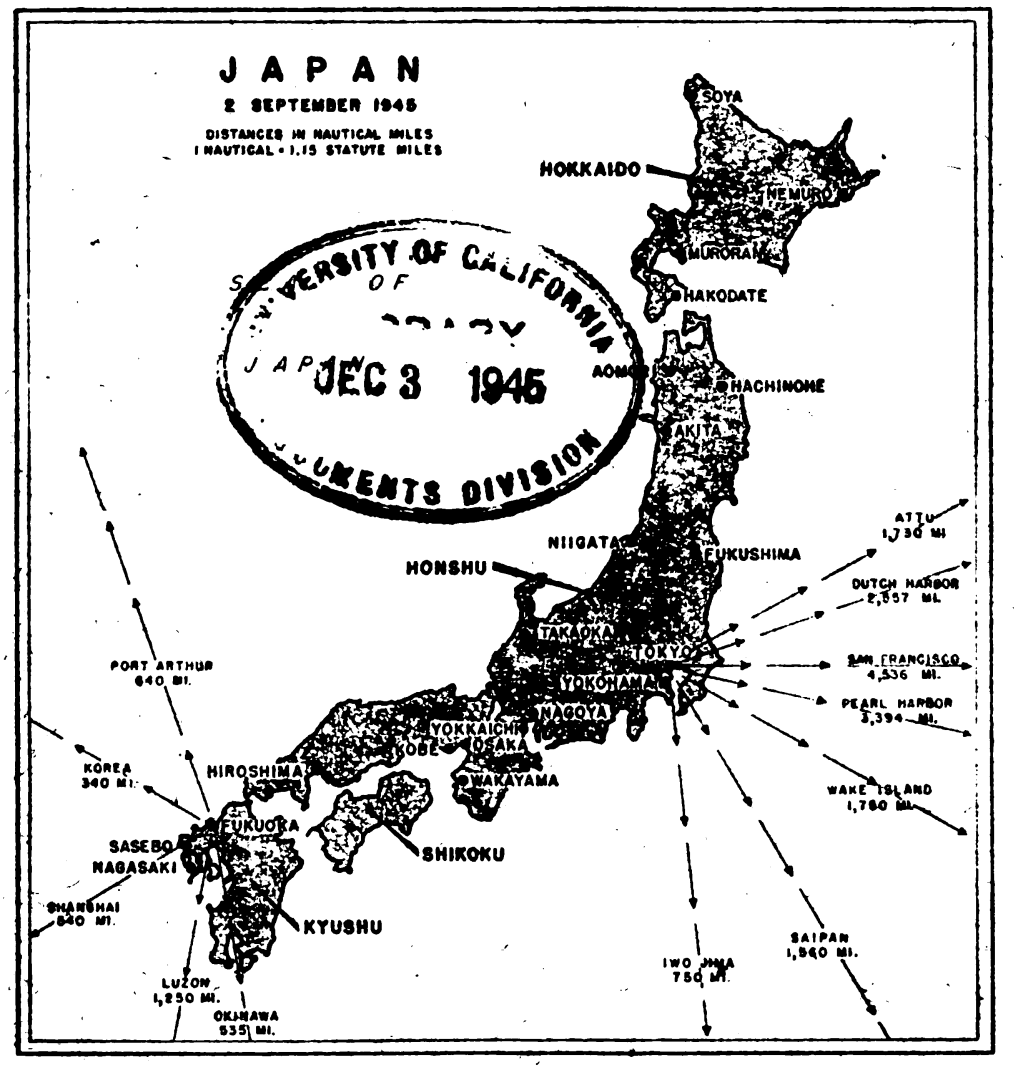
VOL. IV, No. 5 NOVEMBER 1945

THE BULLETIN

OF THE

U. S. Army Medical Department

A periodical containing original articles, reviews, news, and abstracts of interest to the Medical Department of the Army



ISSUED UNDER THE AUSPICES OF
THE OFFICE OF THE SURGEON GENERAL

PUBLISHED MONTHLY AT THE MEDICAL FIELD SERVICE SCHOOL,
CARLISLE BARRACKS, PENNSYLVANIA

By direction of the Secretary of War, the material contained herein is published as administrative information for the proper transaction of the public business and with the approval of the Director of the Budget.

NORMAN T. KIRK,
Major General, U. S. Army,
The Surgeon General.

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WAR DEPARTMENT,
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WASHINGTON 25, D. C.

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Foreword

With the October 1943 issue, The Bulletin became a monthly periodical, instead of a quarterly, dedicated to keeping the personnel of the Medical Department informed on developments in war medicine. The new publication, known as The Bulletin of the U. S. Army Medical Department, absorbed the former quarterly dental and veterinary bulletins and will have material devoted to those fields in each issue.

The Bulletin is intended to be educational rather than directive in nature. It will contain the best information obtainable concerning military medical experience, observations, and procedure that may help to improve further the quality of professional services. The Bulletin will be a medium whereby experience gained in one theater of combat may be shared with those serving in other combat areas and with those in this country who are preparing for overseas duty. News items concerning military and scientific developments as well as original articles will be emphasized. The Bulletin, however, should not serve as a basis for the forwarding of requisitions for equipment or supplies referred to therein.

Obviously, some of the most interesting field experiences cannot be divulged in a periodical of this kind when our country is at war. The Bulletin will, however, publish that which can be safely told, drawing not only on current literature, but on many authoritative reports which reach The Surgeon General's Office from the field. Officers are invited to submit for publication reports of their field experiences that can profitably be shared with other officers.

The Medical Department has been commended for its work in caring for the sick and wounded in theaters of operations in war. The Bulletin will endeavor to stimulate such progress and to advance further the high standard of medical service in the Army of the United States.

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News and Comment

EPIDEMIOLOGICAL STUDY OF SCHISTOSOMIASIS JAPONICA

An opportunity to study schistosomiasis japonica in a previously unexposed group was afforded when American troops became infected after landing on Leyte, P. I., in October 1944. One hundred and two proved cases of schistosomiasis occurred in a combat engineer battalion whose activities were followed closely throughout its stay in a highly endemic area. Sixty-three of the men had been hospitalized because of clinical symptoms, and the remaining thirty-nine were among those hospitalized after surveys of the battalion for eosinophilia had been made. Eosinophil survey is believed to be of definite value in screening large groups for cases of schistosomiasis when an eosinophilia of 30 percent or over is used as the criterion for further study in the hospital.

The experience of these engineer troops showed that the risk of acquiring schistosomiasis in line of duty is closely related to the type of unit and the degree of exposure to infested water. Practically every member of the battalion had the opportunity to swim in infested streams, and many admitted doing so, but the vast majority of the infected soldiers were from platoons engaged in bridge repair and construction. Among these platoons the attack rate varied from 71 to 89 percent, rates which might have been raised to almost 100 percent if all the men had been hospitalized for careful study.

Failure to find the snail intermediate host, *Oncomelania quadrasi* (also referred to as *Schistosomophora* or *Oncomelania hydrobiopsis*), is no criterion of the safety of the stream in question. The breeding places of the snails in grassy marshes and small tributary streams may be located nearly a mile above the point at which troops became infected. Since the cercariae live fifteen to thirty hours and attach themselves to the surface film after emergence, they may be carried passively considerable distances by moving water within a few hours.

The study showed the need for investigation of cercaricidal applications to the skin and clothing. Rubber boots or other protective equipment should be provided for certain engineer and other troops forced to work in surface water in known or suspected endemic areas. Education of troops and strong command action to prevent exposure by swimming, bathing, and washing clothes or vehicles in surface waters should eliminate the disease as a military problem.

Abstract of a paper by Lt. Col. Ralph R. Sullivan, M.C., and Capt. M. S. Ferguson, Sn.C., submitted for publication through The Surgeon General's Office.

CEREBRAL MANIFESTATIONS OF SCHISTOSOMIASIS JAPONICA

A report has been received which describes unusual manifestations of early schistosomiasis japonica in soldiers who contracted the disease on the island of Leyte. One written by Lieut. Colonel Alvin J. B. Tillman, M. C., describes seven instances in which severe cerebral disturbances were attributed to the deposition of eggs in the central nervous system. Confusion, disorientation, memory defects, aphasia, and hyperreflexia were prominent. Muscular flaccidity, present at first, was quickly replaced by spasticity. Sensory disturbances were present in only one case. The patients recovered, but some residual changes were present at the end of three months.

THE RELATION BETWEEN PNEUMONIA AND INFLUENZA

During the pandemic of influenza in 1918 the effort of research workers was directed largely to the bacterial etiology of the disease and to the causes of the severe and often fatal pulmonary complications which occurred with unprecedented frequency. Since that time, epidemics of influenza have not been associated with a comparable number of serious bacterial infections, and research work has been concentrated on the virus etiology of uncomplicated cases. It is now known that two viruses, influenza A and B, both cause widespread epidemics. Each of the eight epidemics of influenza which have occurred in the United States since 1932 has been associated with the presence of one or the other of these two infections as shown by virus isolations and serologic methods.

Although the epidemics of influenza since 1918 have been comparatively mild, they have not been free of associated bacterial complications. Collins and Gover of the U. S. Public Health Service have shown that during each of these epidemics there has been a definite excess mortality from pneumonia. Each of these excesses has been small in contrast to the extreme mortality in 1918, but their cumulative total has almost equaled the total losses during that pandemic.

Many of the pneumonias which have occurred during recent influenza epidemics have been of bacterial origin. Clinicians, both in civilian and military hospitals, have observed a sharp increase in the frequency of pneumococcal and other bacterial pneumonias during and immediately after epidemics of influenza. Numerous workers in the past ten years have demonstrated the simultaneous occurrence of influenza A or B virus with severe pneumococcal and staphylococcal pneumonias. The pulmonary pathology has borne a close resemblance to that seen during the 1918 pandemic. Some of these cases have been so fulminating in nature that intensive therapy with sulfonamide drugs and peni-

Prepared by the Commission on Acute Respiratory Diseases, Army Epidemiological Board.

cillin has failed to prevent death. Other cases have responded to treatment. While modern therapy gives promise of curing many of the types of cases which were fatal in 1918, there is no assurance that a pandemic in the future would not be a disaster. The relation between pneumonia and influenza remains an important problem.

The Commission on Acute Respiratory Diseases has attempted to collect data on this problem at Fort Bragg, N. C. Great difficulty has been encountered because of an extremely low incidence of bacterial infections of any type over a period of three years. During the epidemic of influenza A in the fall of 1943 the character of the pneumonias seen in the Station Hospital changed markedly from being chiefly of the primary atypical variety to acute pneumococcal infections. Following the epidemic, primary atypical pneumonias regained predominance. The total number of cases of bacterial pneumonia during the epidemic, however, was small and it was not possible to demonstrate a constant relation between these infections and influenza A in spite of this epidemiological association.

Another approach to the problem has been developed which gives promise of usefulness. Localized outbreaks of specific bacterial pneumonia are known to occur occasionally in institutions and camps, on hospital wards, among families, and even in restricted rural areas. The fundamental causes of these outbreaks are poorly understood. A review of the years of occurrence of these outbreaks, however, revealed that the great majority appeared during the times when epidemic influenza was known to be prevalent. This epidemiological observation suggested that such outbreaks of pneumonia might be secondary manifestations of an underlying influenza epidemic.[1]

Confirmation of this possibility has been obtained in two instances. A localized outbreak of type I pneumococcus pneumonia occurred in Northville, New York, in the winter of 1940. The New York State Health Department studied the outbreak, including in their investigations the collection of blood specimens from a sample of the normal population. Recently these sera were tested for antibodies to influenza. Increases in antibody titers to influenza B were demonstrated in 4 of 55 individuals, suggesting that this infection had been prevalent concurrently with the type I pneumonia outbreak. It is of interest that influenza B virus was first isolated during the same season in other parts of New York State.

During April 1945, acute and convalescent blood specimens were secured from 17 cases of pneumonia and acute respiratory disease from an Army air base where there was a high incidence of pneumonia. Serologic studies revealed the presence of recent

1. The Relation Between Epidemics of Acute Bacterial Pneumonia and Influenza, Commission on Acute Respiratory Diseases and the New York State Department of Health, in press.

influenza B infection in 7, or 41 percent, of the total tested. Shortly after this finding, localized outbreaks of influenza B were reported from several other posts in the country.

In neither of these two outbreaks of pneumonia was the presence of influenza within the population apparent on clinical or epidemiological grounds. It is clear that influenza may occur under some conditions without being recognized either by physicians or by the public. The existence of an unusual prevalence of bacterial pneumonia, therefore, may be a useful clue to the discovery of an unsuspected prevalence of influenza.

Other virus infections may predispose to bacterial infections of the respiratory tract. For example, many severe cases of streptococcal pneumonia accompanied the epidemic of measles in the Army in the spring of 1918. Many other factors may also contribute to the occurrence of outbreaks of pneumonia. The frequency with which influenza is the underlying factor remains to be determined. However, the frequency of occurrence of these outbreaks during periods of widespread prevalence of influenza and the two instances of serologic confirmation of this association suggest that influenza may be one of the most important causes of such outbreaks.

The mechanism which controls this association is obscure but an understanding of it is essential to planning rational control measures for the next pandemic. It is possible that there exists a direct relation between the influenza viruses and certain pathogenic bacteria, similar to the complex infection which has been shown to exist for swine influenza. It is also possible that influenza infections in some manner enhance the dissemination of particularly virulent and invasive bacteria. Further study of outbreaks of pneumonia should help to elucidate this problem. Any such outbreaks of pneumonia as well as outbreaks of influenza should be reported promptly to The Surgeon General in accordance with provisions of section III, AR 40-1080.

PRESENT STATUS OF ETIOLOGY OF PRIMARY ATYPICAL PNEUMONIA

The causative agent of primary atypical pneumonia has been intensively sought in a number of laboratories during the past six years. This work has definitely established that the clinical syndrome of atypical pneumonia may be produced by certain bacteria, rickettsiae, fungi, and well-known viruses, especially those of the psittacosis group. The majority of cases occurring in the Army, however, are not caused by any of these known agents, and the search for new agents has constituted the major portion of the investigations.

Using specimens obtained from patients with primary atyp-

Prepared by the Commission on Acute Respiratory Diseases, Army Epidemiological Board.

ical pneumonia, several groups of investigators have reported the isolation of pneumotropic agents in ferrets, mice, mongooses, cats, cotton rats, and guinea pigs, but confirmation of the relation of these agents to the human disease has been lacking. Eaton and his co-workers have produced pulmonary lesions in cotton rats and hamsters, using emulsions of tissue from embryonated eggs inoculated with sputa and lung tissue of patients with atypical pneumonia. Convalescent sera from certain cases of atypical pneumonia have prevented the development of pneumonic lesions in these animals when the sera were mixed with the chick embryo tissue prior to inoculation. Thus far other investigators have failed to confirm these findings. Investigators at the Rockefeller Institute for Medical Research have reported the isolation of an indifferent *Streptococcus* from lungs and sputa of certain cases of primary atypical pneumonia. This organism, termed *Streptococcus* MG, is closely related immunologically to *Streptococcus salivarius*, type I, and is agglutinated by convalescent phase sera from some cases of primary atypical pneumonia. At present the role of the bacterium in the causation of primary atypical pneumonia is obscure.

During the past three years extensive animal experimentation has been done in the laboratory of the Commission on Acute Respiratory Diseases at Fort Bragg, in an attempt to isolate the causative agent of primary atypical pneumonia. Sputa, throat washings, and bloods from patients, as well as pathologic material from fatal cases, have been used. No bacteria or viruses having a direct etiological relation to the human disease have been isolated in the developing chick embryos, in chickens, doves, Java rice birds, mice, guinea pigs, ferrets, rabbits, mongooses, dogs, monkeys, and chimpanzees. In addition, throat washings, sputa, and lungs have been subjected to fractional ultracentrifugation. The various fractions so obtained have been used in animal experiments as inocula and in complement fixation tests as an antigen with acute phase and convalescent phase sera from cases of primary atypical pneumonia. The results have failed to indicate the presence of any specific agent. Examination of the fractions with the electron microscope have likewise revealed no characteristic particles not also found in control specimens.

Because of the negative results in animal investigations, the Commission has studied experimentally the transmission of primary atypical pneumonia in man. About 200 volunteers from conscientious objector groups have been used in these experiments. The results have shown that primary atypical pneumonia can be induced in well subjects by the administration of a pool of sputa and throat washings from patients with primary atypical pneumonia. Furthermore, the disease can be transmitted again from the experimentally infected patient to another normal individual. The disease, likewise, can be induced with bacteria-free filtrates of sputa and throat washings. The clinical characteristics of the experimentally produced illness are in all re-

spects similar to those of the naturally occurring disease as seen in patients in Army and civilian hospitals. About one-fourth of the men inoculated have been susceptible to the disease. The incubation period employing a filtered inoculum has been about fourteen days. No changes in the bacterial flora of the respiratory tract developed following inoculation or during illness in these cases. There was no apparent relation between the presence in the pharynx of the indifferent *Streptococcus* MG, either before or after inoculation, and the development of primary atypical pneumonia.

The results of these human experiments thus lead to the conclusion that primary atypical pneumonia is at least initiated, if not caused in its entirety, by a filter-passing agent, presumably a virus.

SELECTIVE METHOD FOR ISOLATION OF HEMOLYTIC STREPTOCOCCI FROM THROAT SWABS

A single throat swab streaked directly onto a blood agar plate is usually sufficient to demonstrate beta hemolytic streptococci from patients ill with a true streptococcal pharyngitis or tonsillitis. An occasional culture will fail even with such patients, but repeated cultures will demonstrate the organism.

To institute adequate control measures, it is frequently important to identify healthy carriers of these organisms. In healthy carriers with comparatively few organisms present, hemolytic streptococci frequently are not detected by the usual methods of identification from a single throat culture. A method of increasing the accuracy of carrier identification has been described.[1] [2] Beef heart infusion broth containing 1 percent tryptose, 0.02 percent glucose, and 5 percent rabbit blood is tubed in 2 ml. amounts. On the day the medium is to be used, 0.15 ml. of an autoclaved aqueous solution of sodium azide, 1:1,000, and 0.1 ml. of autoclaved aqueous solution of crystal violet, 1:25,000, is added to each tube. Swabs are placed in these tubes within one hour after culturing the throat. After incubation overnight, subcultures are made on blood agar plates by streaking from broth. Pike reported an increase in the apparent carrier rate from 12 percent when plates were inoculated directly from swabs, to 39 percent when his technique was employed. These observations were made on children without respiratory infections. That the method is equally advantageous in adults has been shown by the U. S. Army Commission on Acute Respiratory Diseases.

Prepared by the Commission on Acute Respiratory Diseases, Army Epidemiological Board.

1. Pike, Robert M.: Enrichment Broth for Isolating Hemolytic Streptococci from Throat Swabs, Proc. Soc. Exp. Biol., N. Y., 57:186-187, Nov. 1944.

2. Pike, Robert M.: Isolation of the Hemolytic Streptococci from Throat Swabs, Am. J. Hyg., 41:211-220, March 1945.

EPIDEMIC OF SEPTIC SORE THROAT

An epidemic of septic sore throat due to beta hemolytic streptococci of group A, type 5, occurred in two companies of an airborne infantry regiment of about 250 men and resulted in the hospitalization of 100 men. Epidemiological evidence incriminated creamed eggs served at breakfast as the probable vehicle of infection. The outbreak was explosive in onset, with an average incubation period of thirty-eight hours and a primary attack rate of 42 percent (figure 1). Almost all subjects originally infected became clinically ill. As a result of contact spread, secondary cases and carriers continued to appear for five weeks after the onset of the epidemic. The secondary attack rate was 30 percent, of which half were cases and half carriers.

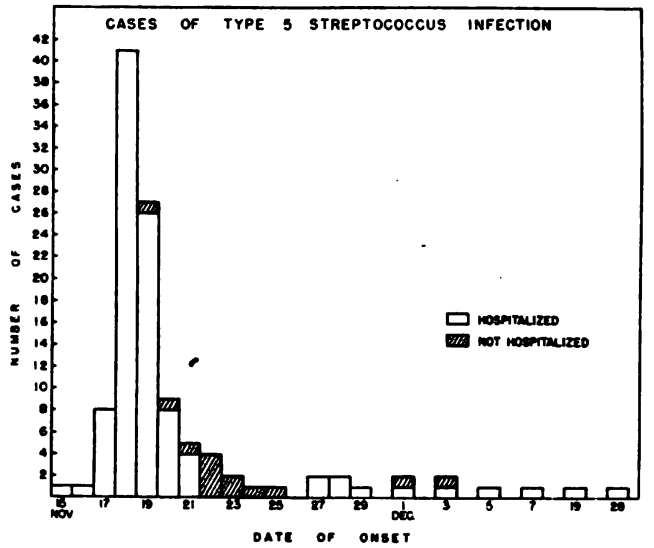


FIGURE 1. Distribution of cases of type 5 *Streptococcus* infection by date of onset of symptoms.

The illnesses produced by epidemic type 5 *Streptococcus* infection were mild to moderately severe and did not differ appreciably from sporadic contact, or air-borne, cases of tonsillitis and pharyngitis caused by other types of streptococci. Alternate patients were treated with sulfadiazine, administered for six days with a total dose of about 30 grams per patient. Slight reduction was demonstrated in the daily frequency of certain symptoms, particularly sore throat, but no objective evidence of benefit was found with regard to the local inflammatory reaction. Only a slight decrease in the height

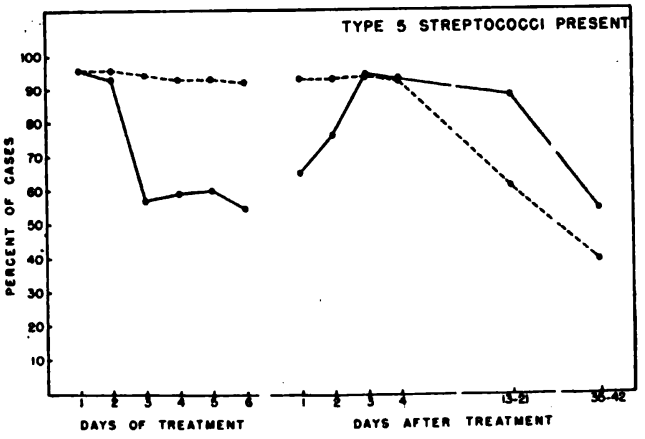


FIGURE 2. Frequency of type 5 streptococci in daily throat cultures. Solid line represents cases treated with sulfadiazine; dotted line, cases not receiving specific treatment.

Abstract of a paper from the Commission on Acute Respiratory Diseases, Fort Bragg, N. C., to be published in Bulletin of the Johns Hopkins Hospital.

and duration of fever resulted from sulfadiazine treatment. While chemotherapy effected striking reductions in total and differential leukocyte counts and in the daily prevalence of beta hemolytic streptococci in the throat, the changes were transitory and persisted only during the period of treatment (figure 2). From the standpoint of practical therapeutics, no worth-while benefit was derived from chemotherapy in this epidemic.

While suppurative complications were few, a considerable number of nonsuppurative complications were detected. These included three cases of acute rheumatic fever and two others in which that diagnosis was suggested but not established. Four other patients had unexplained febrile relapses of one to four weeks' duration. In addition, four other subjects who were symptomatically well had transient electrocardiographic changes in the T waves of limb and precordial leads. In some individuals these changes probably were not of pathologic significance, but in others the changes may have been indicative of rheumatic myocarditis. One probable exacerbation of chronic glomerulonephritis was encountered, but there were no examples of acute glomerulonephritis. Transient microscopic hematuria and other urinary abnormalities were detected frequently in the early course of the illnesses. They may have been instances of "focal" nephritis.

A significant rise in titer of antistreptolysin or antifibrinolysin was found during convalescence in 85 percent of hospitalized cases. Similar antibody responses appeared in nearly half of healthy carriers indicating that a proportion of "healthy" carriers were subclinical cases. Transient carriers did not exhibit an antibody response while those who carried the organisms for more than ten days did.

A clear relation was demonstrated between streptococcal parasitism and the presence or absence of tonsils. Subjects with tonsils frequently had confluent exudate, harbored the organisms in large numbers in early cultures, and tended to remain chronic carriers. Subjects whose tonsils had been removed had less exudate, fewer streptococci, and rid themselves of the organisms sooner.

THE ETIOLOGY OF INFECTIOUS HEPATITIS

The etiological agent of infectious hepatitis has not as yet been actually "isolated" in the sense that it has been seen, cultured, or transmitted experimentally to laboratory animals. It is known to be present in the blood and feces of patients in the pre-icteric or early icteric phases of the acute disease, and to withstand heating to 56° C. for at least one-half hour. It has also been filtered through bacteria-tight filters and for this reason has been classified as a virus. Data on the limits of time (during the incubation period and active disease) in

Prepared by Dr. John R. Paul, director, Commission on Neurotropic Virus Diseases, Army Epidemiological Board.

which this "virus" may be found in human peripheral blood or feces are scanty, but there is good reason to believe that the virus is most readily demonstrable in the pre-icteric and early icteric periods. The exact limits of the intestinal carrier state remain to be determined.

Attempts to infect common laboratory animals, including many rodents and species of monkeys and even chimpanzees, have failed. While claims have been made of the propagation of this agent in the developing chick embryo and of its transmission to birds and pigs, those reports have not been confirmed.

To date almost all of the properties of this virus have been determined by using human volunteers. Such experiments on human volunteers have also yielded some information on the route by which man may be infected experimentally. It is now known that infectious hepatitis may be transmitted to man experimentally by *feeding* feces (or serum) containing the icterogenic agent. This evidence suggests that the *intestinal-oral* route may be of importance in the natural spread of the disease. It fits in with the facts observed in some military populations which tend to correlate a high incidence of hepatitis with bad camp sanitation and frequently with the association with intestinal diseases.

Experimentally it has also been shown that infectious hepatitis may be produced in man by parenteral inoculation of small amounts of infectious material (serum). In this connection its artificial spread through the use of improperly sterilized syringes is a point of consideration. The stability of the icterogenic agent and the infectiousness of small (0.01 cc.) quantities of serum suggest that it may be transmitted artificially more often than is realized. This suggestion is based on the frequency with which the agent of serum jaundice, which may be closely related to that of infectious hepatitis, has been transmitted as a result of transfusions and of serum injections.

DIAGNOSIS OF BETA HEMOLYTIC STREPTOCOCCAL PHARYNGITIS AND TONSILLITIS

The differentiation of streptococcal exudative pharyngitis and tonsillitis from nonstreptococcal infections has been investigated by the Commission on Acute Respiratory Diseases. About 10 percent of all respiratory admissions in one Army hospital* were found to have exudative tonsillitis or pharyngitis.[1] A study of 116 of these patients by clinical, bacteriologic, and immunologic methods has emphasized the difficulties in diagnosing beta hemolytic streptococcal tonsillitis or pharyngitis in the absence of a scarlatiniform rash. Streptococcal infections in this study were considered definite only in pa-

*Regional Station Hospital No. 2, Fort Bragg, N. C.

1. Endemic Exudative Pharyngitis and Tonsillitis, Commission on Acute Respiratory Diseases, J.A.M.A., 125:1163-1169, 26 Aug. 1944.

tients who harbored beta hemolytic streptococci in the throat and who developed antibodies to the *Streptococcus* during convalescence. There were 28 streptococcal infections, another 28 patients harbored streptococci but did not develop antibodies, and in the remaining 60 men no streptococci were obtained from cultures of the throat.

A diagnosis of a streptococcal infection was difficult in many instances to make on the basis of clinical evidence alone. It is true, however, that symptoms in the 28 men with streptococcal infections developed rapidly and reached maximum intensity within twenty-four to forty-eight hours of onset. Likewise, enlarged tender cervical lymph nodes were present and examination of the throat of these patients showed that in general there were diffuse redness and edema of the tonsils, uvula, and oropharynx. In distinguishing the streptococcal from the nonstreptococcal infections, the extent of the exudate was of considerable importance. Beta hemolytic streptococci were cultured from about 70 percent of the patients who exhibited confluent exudate beta hemolytic streptococci, whereas only 30 percent of the patients with exudate measuring a few millimeters in diameter harbored streptococci.

Both the leukocyte count and the number of beta hemolytic streptococci isolated from the throat are helpful in differentiating streptococcal from nonstreptococcal infections of the respiratory tract. The average total leukocyte count was 16,000 in patients with streptococcal infections, whereas in the group who harbored streptococci but did not develop antibodies, and the group of 60 men from whom no streptococci were isolated, the average count was 9,000. Cultures of the throat streaked on blood agar plates showed that when large numbers of beta hemolytic streptococci were present, the infection was more likely to be due to the *Streptococcus* than if only a few colonies were found.

MEDICAL RESEARCH AND DEVELOPMENT BOARD

The Army Medical Research and Development Board was constituted in The Surgeon General's Office on 1 September 1945 to be responsible for the planning and general supervision of all Medical Department research and development activities. Its membership will include the chiefs of the various professional services and divisions of the Office of The Surgeon General; the Air Surgeon; the Surgeon, Army Ground Forces; the Chairman of the Division of Medical Sciences, National Research Council (by invitation); and the Chairman of the Committee on Medical Research, Office of Scientific Research and Development (by invitation). The Board has two operating divisions, (1) research and (2) development, to carry out its plans.

It is the intent of The Surgeon General to carry on an active program of research and development during the post-

war period. The new Board should provide the means for maximum coordination of effort within the military service and cooperation with civilian and Federal research agencies. The immediate tasks facing the Board are three in number. Essential research must be continued in the existing Medical Department research and development laboratories in spite of the personnel difficulties of the period of demobilization. Plans must be made and implemented for the continuation or actual expansion of research and development in the postwar period. The demobilization of the Office of Scientific Research and Development necessitated finding other sponsorship for those CMR research contracts which warrant continuation even though hostilities have terminated. A sizeable group of these contracts will be taken over by the Medical Department and administered by the Army Medical Research and Development Board.

The key to effective research is largely a matter of personnel. The splendid accomplishments of medical research during World War II were due to the availability of such personnel, most of whom contemplate return to civilian life. Means must be found to retain or obtain the type of personnel who can maintain Medical Department research at the high level so essential to the continued advancement of military medical service.

MALARIA CONTROL OVERSEAS

Malaria was an acute problem among troops in the tropical theaters during the first two years of the war. The early campaigns in New Guinea and the Solomons were fought with inadequate antimalarial supplies and without proper preparation to control mosquitoes. For a time, casualties from malaria in the Pacific were eight times those from Japanese action. High malaria rates prevailed also among troops operating in tropical Africa and in India-Burma. It became urgently necessary to establish an orgnization of specially trained personnel to study and combat this disease.

By December 1942 a special malaria control organization was established in the Medical Department to assist commanders in the discharge of their responsibility for malaria prevention and to conduct an effective program of mosquito control in overseas theaters. This organization consisted of specially trained malariologists, malaria survey units, and malaria control units. A chief malariologist was appointed in each theater of operation in which malaria was a problem. These malariologists planned and supervised the malaria control program and acted as liaison officers between higher headquarters and the malaria survey and control units in the field.

Malaria control units are small mobile teams of eleven men commanded by a Sanitary Corps officer specially qualified in the engineering aspects of malaria control. The survey

units, likewise, are small, eleven-man teams which can function as a mobile laboratory. They are supervised by two Sanitary Corps officers—one an entomologist trained in mosquito survey and identification techniques, the other a parasitologist trained in laboratory and field procedures in malaria surveys, such as blood examination for malarial parasites. The survey and control units work in conjunction to determine the sources of malarial infection and to carry out the appropriate control measures.

In February 1943, the special medical malaria control organization began to function in the field. Twenty-eight survey and 49 control units had been activated, trained, and shipped from this country by the end of 1943. Six other control units were activated locally in oversea theaters. At the end of the war a total of 68 survey and 146 control units were functioning in theaters of operation; also, more than 60 Medical Department officers had been assigned as malariologists. The total personnel specially designated for malaria control overseas was thus about 345 officers and 2,350 enlisted men. These men served as a dynamic nucleus for malaria control activities. Thousands of native laborers were employed under their direction. Also, they aided in the malaria control training of troops and supervised the work of unit antimalarial details. The mission of the malaria control organization has included the prevention of other insect-borne diseases as well as malaria—in particular, dengue, scrub typhus, and filariasis. Because of their special training, malaria units also have been used to assist in the control of certain other diseases such as schistosomiasis and those spread by rodents.

The situation in regard to malaria in the last two years of the war improved vastly in spite of the fact that operations continued in highly malarious territory and involved larger numbers of troops. Malaria rates dropped dramatically after their peak in June 1943. Losses from malaria were reduced to a point where they were not a significant influence on military operations. The decisive factor in bringing about this reduction was the activities of the special medical malaria control organization. The survey and control units accomplished remarkable feats of mosquito control, not only in base areas but also, frequently, in forward zones. Moreover, the organization contributed greatly to the improvement of malaria discipline among troops, especially in the taking of suppressive atabrine, which was a highly important factor in reducing the noneffective rate. In most theaters the drop in malaria rates paralleled closely the building up of the malaria control organization. The Army's experience has demonstrated that an organization specially trained and equipped for malaria control and specifically assigned to this duty is essential for the effective control of this disease, which has been the greatest hazard, medical or otherwise, to military operations in the tropics.

MALARIA CONTROL

(1) Filipino laborers clearing creek banks at Pampanga, Luzon, for the 110th Malaria Control Unit. (2) Closed flume in process of construction to drain a lagoon near the ocean. The rise and fall of the ocean will continually flush the lagoon, and this change in water level will destroy mosquito breeding situations. Discarded gasoline drums opened at each end and welded together are used for the flume tube. (3) Spraying stagnant waters with oil to kill mosquito larvae. Bougainville. (4) Power oiling unit pulled by tractor and capable of throwing oil 50 feet or more. Efate, New Hebrides. (5) Members of the 165th Malaria Control Detachment use an amphibian truck to spray river area near Dumdum, India. 16 June 1945. (6) Coolies in Mohanbari, India, roll barrels of DDT to truck for transportation to B-25 planes for spraying. 1 July 1945.

DENTAL TREATMENT PRIOR TO SEPARATION FROM ARMY

The Surgeon General desires that all separatees be given as complete a dental service as possible prior to separation from the Army. Attention is directed to War Department Technical Manual, TM 8-255, 10 September 1945, section VII, paragraph 27, which states: "Individuals having Class I dental defects which are incapacitating or likely to interfere with performance of duties in military or civilian life, or individuals who have lost anterior teeth in line of duty, will be provided with appropriate treatment and/or prosthetic appliances prior to separation if the individual so desires. Routine dental treatment, such as for Class II's, etc., may be provided for individuals providing time, facilities, and dental personnel are available, and providing the individual elects to have such treatment." Every effort should be made to use existing dental facilities to the fullest capacity, and when such dental facilities are inadequate, additional dental equipment should be installed in other available quarters to meet the local demands. Dental personnel, officers and enlisted men, should be shifted within the service command to permit the greatest service.

Under provisions of AR 40-510, C 1, paragraph 5*b*(3), 10 September 1942, the procurement of civilian dental laboratory service may be authorized by commanding generals of service commands where adequate dental laboratory facilities are not available and when there is insufficient time to have the cases completed at central dental laboratories. Requests will be made to the commanding general of the service command in which the station is located for authority to have dentures completed in civilian laboratories. This request may be for a single case or a certain number of cases. Payment for such civilian dental services will be accomplished in accordance with AR 40-505, C 8, paragraph 3*j*, 6 September 1944.

SELECTION AND TRAINING OF MEDICAL OFFICERS FOR THE REGULAR ARMY

Of interest to medical officers now in or contemplating entering the Regular Army are plans for professional training. The Training Division of The Surgeon General's Office is now coordinating action on the part of many consultants of the Medical Department which will enhance professional ability at all levels. Important is the establishment of a long-range program to obtain the best young medical graduates as future Regular Army medical officers.

To attract qualified officers currently in the Army and future officers of the highest caliber, definite inducements are offered. There should be a guarantee of professional opportunity equal to or above that offered in civil life, promotion and pay commensurate with professional effort, and economic

security. The immediate problem is to secure certified specialists and action has already been taken along the following lines:

Qualified Regular Army medical officers are being assigned as understudies to chiefs of services or sections. Certain Army hospitals are being selected for establishment of graduate training programs (residencies) which will meet requirements of the appropriate civilian specialty boards. The Surgeon General has been authorized to place on detached service certain medical personnel for specific understudy of key professional positions. As Regular Army Medical Corps officers become available for reassignment, they will be placed in installations for graduate training. The Training Division will maintain a record of progress of these officers. Army followships in teaching and research institutions will be established. Army internships will be established at selected general hospitals for young officers. Courses in civilian medical schools have been made available to selected officers in public health, preventive medicine, and similar subjects.

For officers not initially selected for specialty training, assignment in general will be to less specialized positions, to tactical medical units, and to general administrative and staff positions. It is considered important that opportunity for future advancement by special training be accorded these officers, either in professional or staff and administrative positions.

After acceptance for specialized training, officers will be assigned to appropriate Army and civilian institutions, with two-thirds of the time allocated to the former. On completion of this training, officers will be assigned to Army institutions where practical experience in the specialty will be available. The Surgeon General has appointed a committee to implement and supervise these plans. The chairman is Colonel Floyd L. Wergeland, director of the Training Division. Further developments will be announced.

RECRUITING ENLISTED MEN FOR THE MEDICAL DEPARTMENT

The Surgeon General desires that every Medical Department officer familiarize himself with the advantages of the Regular Army as a career for enlisted men and urge qualified enlisted men serving under their immediate jurisdiction to consider the Medical Department of the Regular Army as a career or at least for one enlistment. Additional advantages of the Army as a career are frequently being announced, and it is suggested that Medical Department officers consult local recruiting officers for full information.

CAMP SIBERT—UNIT MEDICAL TRAINING CENTER

Camp Sibert, Alabama, was established as an Army Service Forces training center on 11 June 1945 and was the only training center devoted exclusively to training Medical Department units during the recent war.

Colonel Wilbur G. Jenkins, M.C., was commanding officer of both the post and the training center. Shortly after assuming command he visited the Pacific Ocean Area and Southwest Pacific Area to confer with theater surgeons and unit commanders on subjects which should be stressed in training units to be redeployed to the Pacific. These were diseases and conditions peculiar to anticipated assignments, personal health, security measures, protection of matériel, and field training, including improvisations.

Training began at Camp Sibert during the latter part of August and plans were made to train ninety-eight units there during the ensuing eight months, with a peak training load of 23,000 personnel expected during December 1945. The units to be trained included: 45 numbered general hospitals, 14 station hospitals, 12 field hospitals, 9 hospital centers, 2 gas treatment battalions, 3 hospital trains, 2 auxiliary surgical groups, 1 convalescent center, 1 medical laboratory, 4 malaria control units, and 5 veterinary food inspection teams.

As the need for all of these units no longer exists because of the early collapse of Japan, those units to be retained and trained will be transferred to either Camp Crowder or Fort Lewis where Medical Department training will be continued.

Harnessing Fifth Army mules while in the background 105-mm. howitzers are firing. Italy. 27 September 1944. Signal Corps photograph.

REFRESHER TRAINING IN NEUROPSYCHIATRY

The Surgeon General notified the commanding officers of the following hospitals, on 10 September 1945, that their medical services had been approved for the professional refresher training of Medical Corps officers to extend over a twelve-week period:

Cushing General Hospital, Framingham, Massachusetts.
DeWitt General Hospital, Auburn, California.
Kennedy General Hospital, Memphis, Tennessee.
Mason General Hospital, Brentwood, Long Island, New York.
McCloskey General Hospital, Temple, Texas.
Newton D. Baker General Hospital, Martinsburg, West Virginia.
Percy Jones General Hospital, Battle Creek, Michigan.
Valley Forge General Hospital, Phoenixville, Pennsylvania.
Winter General Hospital, Topeka, Kansas.

Medical Corps officers desiring refresher training in neuropsychiatry will be permitted to serve the entire twelve weeks on the neuropsychiatric services and to rotate through the various wards of the neuropsychiatric services in order to gain experience in all phases of neuropsychiatry. The refresher course will follow the Guide for Professional Refresher Training for Medical Corps Officers approved 17 November 1944, and ASF Circular No. 41, 5 February 1945.

PSYCHIATRIC SOCIAL WORKERS

The Psychiatric Social Work Section of the Neuropsychiatry Consultants Division has prepared a suggested in-service training program for military psychiatric social workers which has been distributed to installations within the service commands where military psychiatric social workers (SSN 263) are assigned. This program is substituted for the original plan (to establish two schools for psychiatric social workers in the eastern and western sections of the country) which was eliminated following VJ-day, when training programs were curtailed.

About half of the course content is directed toward orientation to psychiatry, and the remainder is directed toward social case work practice in the military setting. It is supplementary to presently operating programs, of which there are a number now organized.

Service commands were canvassed for information about training programs being conducted for this group of personnel, and the present program was based on the information thus obtained. The need for a coordinated training program was emphasized, because of the wide variations in present programs and the immediate problem of training new personnel to replace those being separated from the service.

PSYCHIATRIC NOMENCLATURE

For more than a year, the Neuropsychiatry Consultants Division has been developing a revised psychiatric nomenclature which has now been completed and approved by the Army Ground Forces and the Army Air Forces. It is planned that this will appear in a revision of all medical nomenclature in a technical medical bulletin to be issued by the Statistics Division.

Probably most significant in this nomenclature is the trend towards dynamic interpretation of the illness. All of the diagnostic terms are described as being reactions. The terms, "psychoneurosis" and "psychosis," are used only as applying to a group of reactions and the specific types will each be recorded without this term prefixed to it. In addition, the nomenclature includes a group of "somatization syndromes," terms to apply to the functional gastrointestinal, cardiac, and other visceral disturbances. The older terms of "simple adult maladjustment" and "constitutional psychopath" have been deleted.

SCHOOL OF MILITARY NEUROPSYCHIATRY

The School of Military Neuropsychiatry at Mason General Hospital completed its twenty-second course on 1 October, graduating 101 men. Colonel William C. Porter continues as director of the course. Doctor Edward A. Strecker, professor of psychiatry, University of Pennsylvania, delivered the graduation address for this class. A class was instituted in military neuropsychiatry at New York University for 50 medical officers, under the direction of Dr. S. Bernard Wortis, professor of psychiatry, New York University, and a class at Columbia University College of Physicians and Surgeons, of 49 officers, under the direction of Dr. Nolan D. C. Lewis. Captain Norman Reider began acting as coordinator for these two classes.

The twenty-third class at Mason was scheduled to open 1 October for 85 students.

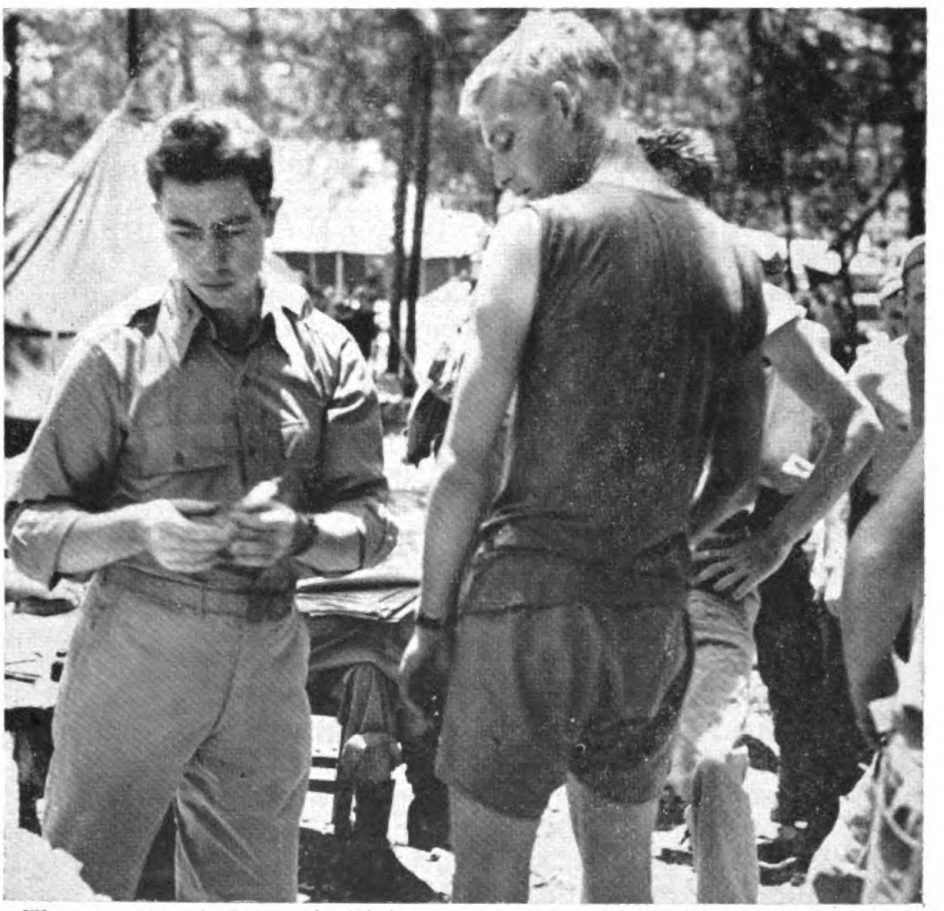
PSYCHONEUROSIS

A pamphlet entitled "What's the Score in a Case Like Mine?" is being distributed to Army Service Forces hospitals in the zone of the interior to assist medical officers in the treatment of military personnel to be discharged from the service because of psychoneurosis. This W.D. Pamphlet 21-35 provides information which has been found helpful to such patients in recovering and in adjusting to civilian life. A copy will be given each patient at the time it has been determined he will be separated from the service for psychoneurosis under the provisions of AR 615-361, except in cases where the attending medical officer considers this contraindicated. Additional copies can be obtained by requisition from the Adjutant General's depots.

TRANSFER OF CLINICAL PSYCHOLOGISTS TO MEDICAL ADMINISTRATIVE CORPS

The long-awaited transfer of the services of the clinical psychologists to the Medical Department has taken place. W.D. Circular No. 264, 1 September 1945, authorizes the transfer of the functions of the Office of the Chief Clinical Psychologist, Classification and Replacement Branch, Operations and Training Division, Adjutant General's Office, and the personnel, military and civilian, assigned to the activity, to the Office of The Surgeon General, effective immediately. In addition, this directive authorizes that the clinical psychologists appointed under provisions of paragraph 3*e*, AR 140-22, 18 November 1940, and AR 605-10, 26 May 1944, who are used under the provisions of W.D. Circular No. 264, be detailed to duty with the Medical Department (M.A.C.). This is a forward step in developing the close relationship for teamwork between the psychiatrist, psychologist, and social worker.

JAPANESE B ENCEPHALITIS VACCINE



The troops of the 27th Division were the first to receive Japanese B encephalitis vaccine (see *The Bulletin*, March 1945, page 32) to protect them against this type of encephalitis, which in the Japanese area reaches the epidemic stage in August and September. 12 August 1945, Okinawa. Signal Corps photograph.

ARMY OPERATES LOST AND FOUND DEPARTMENT IN FRANCE

The U. S. Army operates what is probably the world's largest lost and found department, at Folembray, Aisne, France, where, at the Quartermaster Personal Effects and Baggage Depot, more than 100,000 pieces of baggage and parcels of personal property await the claim of their owners. Property belonging to men who have been wounded in action and hospitalized comprises 41 percent of all the personal effects, other than ordinary baggage, handled at the depot. Many of these men have been in several hospitals and then through a number of replacement companies for eventual reassignment to a new unit. Personal effects of men killed in action are forwarded by the depot to the next of kin through the Army Effects Bureau in Kansas City, Missouri.

Soldiers who have lost property in the European Theater write the depot through their commanding officers and, if the property is not in storage, systematic inquiries are made throughout the Continent and England. In addition to property, the depot also forwards money left behind by soldiers. During the past year, $1,876,000 has been forwarded to owners or, in case of death, to beneficiaries. Actual cash is not sent, but money found with effects is turned in to Army Finance and credited to the soldiers' accounts. Extreme precautions are taken by the Personal Effects Depot to guard against loss or theft.

In one year of operation up to 1 July 1945, the depot handled 406,000 pieces of baggage or packages of personal effects. The depot is commanded by Colonel A. C. Ramsey of Osage City, Kansas.

ARMY HOSPITAL SAFETY PROGRAMS

The importance of the safety factor is intensified in Army hospitals by the special danger in every hazard present. The complete or partial incapacity of bed patients, the dependence of patients on prosthetic appliances or other artificial aids, and their restricted mobility demand all possible precautions against accidents and that all attendants as well as the patients participate in a safety program.

The mere publication of a list of do's and dont's does not constitute a hospital safety program, and the inertia and complacency of a program that is not constantly supervised may in themselves be responsible for avoidable accidents. While protection is generally afforded against obvious dangers, the less obvious hazards often get scant attention. A small leak in an overhead pipe, dripping on a waxed floor, may cause the tip of a cane or crutch to slip, resulting in a fall which aggravates the patient's original injury or permanently cripples him.

To be effective a hospital safety program must be thoroughly organized and supervised and a continuous effort

made by every individual connected with the hospital. Good housekeeping of both equipment and facilities should be repeatedly emphasized. The slightest need for repair that could be a hazard should be reported with dispatch through appropriate central safety authority by anyone observing the need, and such report should be followed up. Conditions, situations, or practices that could be hazardous should be discussed by key personnel at frequent meetings with a view to correction. Some such conditions, situations, or practices are:

1. Improper handling or lifting of heavy objects or persons.
2. Improper use of stairs (obstruction, absence of nonskid material).
3. Smoking in bed (provision of ash trays).
4. Kitchens (greasy floors in the range area).
5. Icy steps or walks.
6. Open drawers of dressers, cabinets.
7. Insecure rugs or floor coverings.
8. Fans or other obstacles inadvertently placed on floors.
9. Equipment in disrepair or poor mechanical condition (without safety device).
10. Falling of insecure objects.

Personnel responsible for the safety program should give particular attention to the following areas and conditions of a hospital:

1. Operating room and clinics, proper care and disposal of instruments, sterilizer utilization.
2. Utility room, storage of combustible supplies.
3. Refrigerator equipment, cleanliness, safety door latch opening from inside, protruding meat hooks.
4. Elevators, safety door locks.
5. Store houses, good storage and warehouse practices.
6. Laundry, housekeeping practices, safety devices.
7. Heating plant, safety rules, compliance.
8. Hot water system, temperature regulator.
9. Electrical equipment, protective covers.
10. Maintenance shops, machine guards.
11. Gas lines, leaks.
12. Rooms and beds occupied by patients.
13. Film storage, fire hazard.
14. Petroleum products and other combustible storage.

The highest standards of housekeeping must be maintained at all times with particular attention given to attics, basements, closets, and other out-of-the-way places.

No safety program will be complete without definitely scheduled inspection for all buildings and equipment. Such inspection should include scrutiny of repairs, sanitation, safety and fire hazards, and protective equipment. Instruction courses in the proper use of fire-fighting equipment, the operation of safety equipment and the use of precautionary measures should always be in effect. Such courses should be by demonstration so that all personnel who might be expected to assist in emergencies can become familiar with the causes of accidents and the orderly steps necessary to meet emergencies that arise.

CONSTRUCTION OF ACCURATE-FITTING TRIAL PLATES

Mark S. Skiff, Jr., D.D.S., consultant in prosthetic dentistry to The Surgeon General's Office, advises that, should undercuts be present, modeling clay be filled in before adapting base plate to the model, to allow easy removal. Adapt base plates to casts by heating and manipulating with finger and rubber eraser.

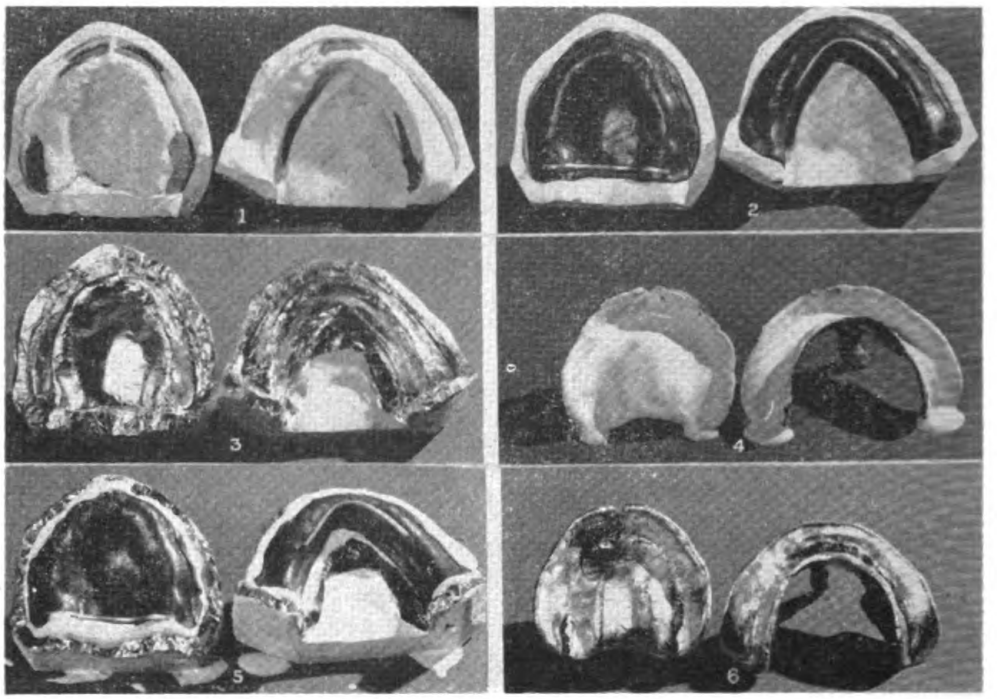


Figure 1. Casts with undercuts filled with clay or Mouldine. *Figure 2.* Adapted base plate with heavy wire reinforcement. *Figure 3.* Tissue tin foil adapted to cast. *Figure 4.* Place zinc oxide resin paste in base plate. *Figure 5.* Press on cast and then set in warm water ten minutes. *Figure 6.* Finish trial plates.

Reinforce base plate with heavy wire. Adapt tissue tin foil to casts with a small, stiff paintbrush about ½ inch wide, called a dusting brush. Place formed base plate over tin foil to better swage against cast. Mix Co-oralite or similar zinc oxide resin paste; place in base plate, covering completely. Place filled base plate on tin foil, which is now covering the cast. Place in warm water and allow paste to set. After the setting period, trim off the excess. For the completion of the trial plates, add the wax bite rims.

Monthly Medical Meeting.—At the meeting of medical officers at the Army Medical Center, Washington, D. C., 19 September, Brigadier General Edward Reynolds, U. S. Army, discussed "Medical Supply Problems in World War II." Major General Norman T. Kirk, The Surgeon General, introduced also Colonel Wibb E. Cooper, M.C., who had been a prisoner of the Japanese since the fall of Bataan and Corregidor.

MEDICAL SURVEY OF REPATRIATED PRISONERS OF WAR

All U. S. Army prisoners of war released in Japan and China will be given a special medical survey on their arrival at ports of debarkation, The Surgeon General announced on 5 September. General Kirk said that those who need additional medical attention will be transferred to Army hospitals, where treatment will be started at once and every effort made to see that these returning heroes get the best medical care the country has to offer.

The surveys will be carried out under the supervision of a board as a joint activity of Army Service Forces and Army Air Forces doctors. Special teams of doctors and technicians will be stationed at ports of debarkation to aid the existing staff in the expeditious but careful examinations which will include the necessary laboratory studies. Specialists will be available in important fields. The members of the board include Brigadier General Hugh J. Morgan, chief consultant in medicine to The Surgeon General, Brigadier General Rex McK. McDowell of the Dental Corps, Colonels W. A. Carlson and W. P. Holbrook of the Air Surgeon's staff, Brigadier General W. C. Menninger, chief consultant in neuropsychiatry, Lieut. Colonel J. T. McGibony, Major G. J. Dammin, and Captain J. S. Hunt. On completion of its mission, the board will submit a report of its findings to The Surgeon General.

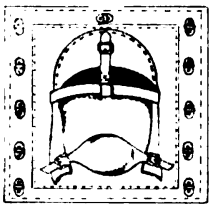
PUBLICATIONS OF THE TRAINING DIVISION

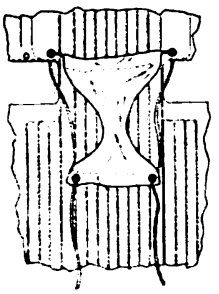
Two completely revised and rewritten manuals will shortly be available for distribution. These are "Handbook for Pharmacy Technicians" (TM 8-233) and "Military Sanitation" (FM 21-10). Two other publications on medical training doctrine have been recently printed: "Medical Department Units of a Theater of Operations" (FM 8-5) and "Guide for Those Giving Rehabilitation Service to the Blind." In the pharmacy handbook, prepared by the Training Division in cooperation with the Subcommittee on Pharmacy of the Division of Medical Sciences, National Research Council, an effort was made to bring all nomenclature, dosages, and methods into agreement with the National Formulary and U. S. Pharmacopeia. "Military Sanitation," in being brought up to date, emphasizes the many uses of DDT. FM 8-5 is a well-illustrated description of medical units in the field and how they function. Combat medical organizations, hospitals, laboratories, depot companies, train and ship units, air evacuation, sanitary companies, and veterinary units are described.

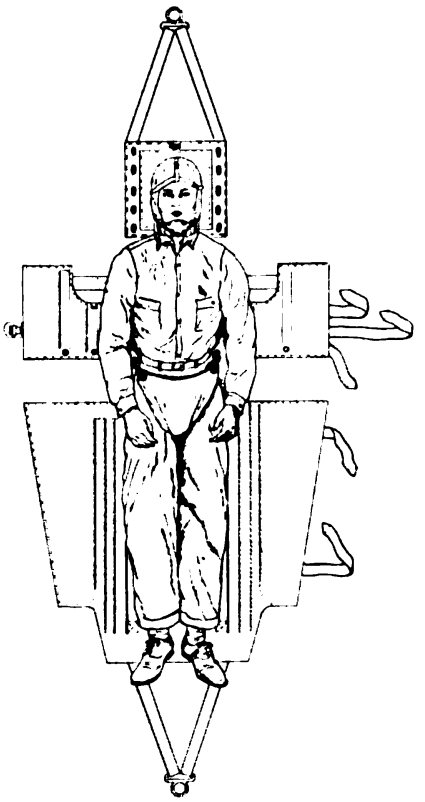
Because of limited application, the pamphlet on rehabilitation service for the blind was issued as an intraservice publication. It was prepared at Valley Forge General Hospital and is for use only at the three centers specializing in this type of work. Extra copies are not available for general distribution.

MODIFICATION OF LITTER TO PREVENT SLIPPING

A modification of the semirigid canvas litter (Med. Dept. Item No. 9936000) has been described by Lieut. Commander George de Tarnowsky (MC), U. S. Navy. The purpose of the modification is to secure the casualty in the litter and prevent him from slipping down when suspended vertically. It is especially useful when an injury of the lower extremity makes it impossible to secure tightly the infolding lower part of the stretcher. The attached seat, made of No. 10 canvas doubled and No. 5 grommets, is 21½ inches long, 13 inches wide at the ends, 3½ inches wide at the center, and is used as illustrated. This modification can be easily made of materials available at practically all posts or canvas working units.







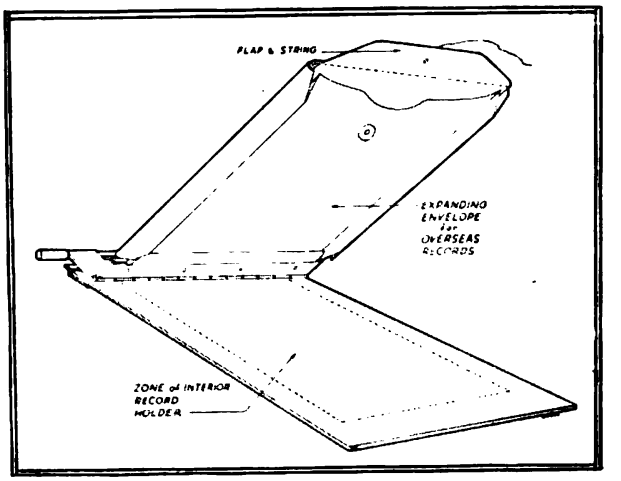
Pharmacist Belton E. Jennings, U.S.N., has suggested that the present webbing chin strap be replaced by a leather cup strap such as is used on the summer flying helmet, as shown in the illustration.

THE AURAL REHABILITATION PROGRAM

War Department Technical Bulletin TB MED 195, which was published on 18 August 1945, outlined the Army's program for the deafened at the three deaf centers—namely, the Borden, Deshon, and Hoff General Hospitals located at Chickasha, Oklahoma; Butler, Pennsylvania; and Santa Barbara, California, respectively. In this bulletin, the methods of testing hearing and the aural rehabilitation program for the deafened as at present carried out in the hospitals were reviewed. This should be very valuable, because, if the tests for determining auditory acuity are properly administered, greater uniformity of results will be obtained.

SECURITY OF OVERSEAS RECORDS IN THE ZONE OF INTERIOR

The misfit of the summary card of the overseas-patient's hospital record (W.D., A.G.O. Forms Nos. 8-27 and 8-28) and that of the patient's record in the zone of interior (W.D., A.G.O. Form No. 8-24) has no doubt been widely observed in the Medical Department. Because of the incongruity of the two records, the overseas jacket and its contents are likely to be mislaid and may be lost. This may be serious for the ward surgeon, who must have an accurate history of previous events, and for the soldier so far as continued treatment and future compensation are concerned. The overseas records are kept in a separate file by some ward surgeons, which means they are less readily available.



Lieut. Colonel Philip Lewin, M.C., Mayo General Hospital, Galesburg, Illinois, suggests that an expanding envelope be secured to the inside of the cover of the zone-of-interior record holder. The envelope should be shaped like a patch pocket and have a flap and string for security, thus preventing the jacket and its record from slipping out.

GUIDE TO SAFE AND EFFICIENT USE OF DDT

Since the use of DDT requires special knowledge and training, a bulletin has been published as a technical guide for the Army, The Surgeon General announced on 18 September. Although DDT may be safely handled as an insecticide, it is a toxic material. Poisoning may occur from ingestion or by absorption of solutions through the skin. DDT powder and aerosols are not absorbed through the skin and have been found to produce no ill effects when inhaled in small amounts; however, where air currents do not carry away the dust, it is wise to wear suitable respirators as protection against excessive inhalation.

DDT acts on insects both as a contact and a stomach poison. The effect of DDT on mosquito larvae is fully as powerful as that on the adult insect, although the larvae of flies are not equally affected by the insecticide. In applying DDT as a mosquito larvicide to open water receptacles, a pro-

longed effect may be obtained. However, in applying it to natural water bodies the effect is much shorter, because of the binding action of mud in the water. It should also be considered that amounts of DDT greater than 0.2 pound per acre may prove fatal to fish and wild life. For extermination of ants, roaches, fleas, bedbugs, and flies, DDT oil solution or powder should be used, with particular attention to cracks, holes, and seams in walls, floors, and bedding, as indicated. In applying DDT solutions to walls and other large surface areas, a coarse spray is usually employed, but in applying it to screens or mesh surfaces, ordinary paintbrushes may be used. Although the effectiveness of the treated areas against insects persists for some time, the insects which come in contact with the chemical may not die until an hour or more has elapsed.

When applying solutions of DDT in kerosene, precautions concerning the inflammability of the kerosene should be observed. Care should be taken to keep electric motors and other sparking or heating apparatus from the zone of spray. No open fires or smoking should be permitted until the spray has dried and ventilation is complete. The kerosene in the solution is harmful to rubber equipment and may cause a mild irritation when in contact with the skin.

DDT has saved many lives in this war and prevented much disease. Extermination of disease-carrying insects has reduced the incidence of typhus, malaria, and other diseases of the war areas. However, much remains to be learned before its full potentialities in insect control can be realized. Investigation is continuing on every aspect of DDT.

TOPICAL PENICILLIN TREATMENT OF PYOGENIC INFECTIONS OF SKIN

In 45 cases of superficial infections of the skin, the clinical results of topical penicillin were correlated with the in-vitro penicillin sensitivity of the organisms isolated. The major offending organism was hemolytic *Staphylococcus aureus* (positive for coagulase production and mannite fermentation), occuring either alone or in association with beta hemolytic *Streptococcus*, group A, C, or G. In 3 cases beta hemolytic *Streptococcus* was the sole pathogen. Penicillin was applied in an ointment base, usually petrolatum, containing 800 units per gram. Sensitivity of the organisms to penicillin was determined by a tube dilution turbidity method, and those which grew in 5 units of penicillin per cubic centimeter were considered resistant.

The therapeutic response generally was related to the initial sensitivity of the infecting staphylococci. Infections harboring sensitive organisms responded well, whereas those

Abstract of paper by Captain Morris Waisman, M. C., A. U. S., and Captain Joseph S. Gots, Sn. C., A. U. S., to be published elsewhere.

harboring resistant organisms did not. If no distinct improvement was noted in three days, usually none would occur with additional treatment. A predominance of penicillin-sensitive staphylococci was isolated from lesions of impetigo and ecthyma. A predominance of penicillin-resistant staphylococci was isolated from lesions of infectious dermatitis (infectious eczematoid dermatitis, secondarily infected dermatoses, dermatitis repens and external otitis). Among 7 cases of folliculitis, staphylococci from 4 were sensitive and from 3, resistant. A total of 22 resistant strains was isolated from the 42 cases which harbored staphylococci. There is some evidence that treating pyodermas with penicillin ointment may in a few cases increase the degree of resistance of staphylococci to penicillin. Resistant strains of beta hemolytic streptococci were not encountered. It is believed unnecessary to perform routine sensitivity studies on the bacteria from cases of pyoderma in which local treatment with penicillin is contemplated, because a therapeutic test will yield practically the same information.

A brave 17-year-old French girl who lost both legs as a result of German shellfire was "adopted" by the U. S. Army First Tactical Air Force Fighter-Bomber Group. Their Christmas gift to her amounted to $2,576, the first expenditure from which was for artificial limbs. A.A.F. photograph.

HISTORY OF MEDICAL SERVICE IN THE UNITED STATES

The projected history of the Army Medical Department during World War II will contain one volume on the development of the medical service in the zone of the interior. Continental United States has served as the base of operations for the most intense and far-flung war effort ever known, and the medical activity has kept pace with the general war activity. Medical service has been provided for over ten million soldiers during the mobilization and training period. Hundreds of thousands of sick and wounded have been returned home from all parts of the world to receive the skilled medical care provided in Army installations. The story of the problems, the achievements, and the failures of so gigantic an undertaking must be recorded to preserve for posterity whatever benefits may be derived from the medical experiences of this war.

The source materials from which the basic data for this volume will be gleaned are numerous. Files of correspondence in The Surgeon General's Office and in the offices of other staff and technical services, printed directives of the War Department and its subordinate commands, and periodic reports of hospitals, ports, posts, camps, and stations will be examined carefully and the pertinent facts organized into a story reflecting the wartime development of military medical service in the United States.

The organizational plan of the volume falls quite naturally into three major sections: (1) hospitalization, (2) transportation of sick and wounded, and (3) miscellaneous medical services. The core of medical service in the United States is the hospital program, the development of the system of general, convalescent, debarkation, regional, and station hospitals, and the planning, procurement, and administration of these installations. The evacuation of sick and wounded from overseas bases and theaters of operation, their further movement from debarkation points to hospitals for definitive treatment, transfers of patients between hospitals, the development and operation of hospital ships, hospital trains, and ambulance planes, the control and coordination of patients' movements—these and other factors make up the story on transportation of sick and wounded. Miscellaneous services such as provided in general dispensaries, prophylactic stations, industrial medicine dispensaries, and separation centers, along with sanitary problems at posts, camps, and stations, will round out the volume.

Professional aspects of the medical services will be discussed in other volumes of the history. The intent of this volume is to present the administrative viewpoint, to trace the planning and implementation of the medical program from the time a limited emergency was declared in 1939 until the wartime Army shall be demobilized and the peacetime military organization established. Involved in the discussion will be

such factors as the calculation of requirements, the construction and administration of hospitals, and the coordination with staff officers, other technical services, and the Veterans' Administration.

It is planned to include photographs, blueprints, maps, organizational charts, statistical tables, and other illustrative materials that will facilitate the reader's understanding of the construction, appearance, distribution, functions, and achievements of Medical Department installations in the United States.

SUGGESTED HOBBLE FOR POSTOPERATIVE SCIATIC NERVE SUTURES

This webbing hobble is a simple method of maintaining limitation of extension in the lower leg during the postoperative stretching period following sciatic nerve sutures. The period of plaster immobilization in flexion following suture of this nerve varies, but must always be followed by a period of gradual extension of the leg until full extension has been reached.

It has been the practice at the Kennedy General Hospital, when the plaster cast came off, to put the leg up in gauze bandage, sheet wadding, and adhesive plaster hobbles, which all too soon became twisted, dirty, unsightly, and unserviceable.

For this reason, First Lieut. Ward C. Meyers, M.C., reports, the illustrated webbing hobble was designed and is now in use on the neurosurgical wards. It can be quickly made in an orthopedic brace shop from materials

readily at hand. All sections of the belt webbing are made adjustable by the use of lock buckles, and the construction of the shoulder piece makes the hobble suitable for use on either leg. The adjustable strap which connects the foot sling to the belt facilitates gradual loosening of the hobble and therefore allows the leg to extend within the limits of the hobble. Active motion of the leg is encouraged. Active motion of the leg at the knee joint is important, as the joint is kept mobile and the attendant muscles do not atrophy. A minor advantage of the narrow webbing hobble, especially in southern hospitals, is its coolness as compared with a bulky bandage.

DIAGNOSTIC CENTER FOR FUNGUS DISEASES

The group of workers studying fungus infections at Duke University has received a grant from the American Foundation of Tropical Medicine for the purpose of acting as a diagnostic and registry center for fungus diseases of man. The service may be outlined as follows: (1) Identification of fungi *already isolated* from patients suspected of having fungus disease. (2) A complete set of cultures of pathogenic fungi will be sent on request to any general, regional, or large station hospital for use in assisting in identification of fungi. To guarantee arrival of the fungi in proper state for study, it is necessary that requests for this material be sent at least one month prior to the time that the cultures will be necessary for demonstration.

By special arrangement, serologic tests will be done in certain of the fungus infections; and vaccines for skin testing and therapeutic use in certain of the fungus infections will be sent on request.

All requests will be handled through the office of Dr. D. T. Smith, Duke Hospital, Durham, North Carolina.

165TH STATION HOSPITAL COMMENDED

Lieutenant General Robert L. Eichelberger, U.S.A., commanding general of the Eighth Army in the Philippines, on 2 August 1945 commended the 165th Station Hospital as follows:

It is with great pleasure that I commend the 165th Station Hospital for its superior performance and outstanding devotion to duty during operations against the enemy from 26 December 1944 to 30 June 1945. The untiring effort and high degree of professional skill evidenced by all officers and enlisted men have contributed materially to the alleviation of suffering of the wounded and the survival of many who were critically wounded.

The inspiring manner in which the 165th Station Hospital has carried out its mission reflects great credit on the Medical Department and the military service as a whole.

PERSONNEL GROUNDING DEVICE FOR USE IN OPERATING ROOMS

The prevention of fires and explosions in the operating room is one of the duties of the anesthetist, and the prevention of accumulations of static electricity on practically every object in the operating room is his big problem. Faulty connections and defective switches can be corrected. However, if two objects bearing charges of different potential approach each other, a discharge accompanied by a spark may occur. How can operating-room personnel be prevented from developing a potential that constitutes a hazard?

FIGURE 1

Among the various safeguards recommended by the National Fire Protection Association is the wearing, by operating-room personnel, of special shoes, conductive in nature. Captain Aaron Cagan, M.C., reports that a simple appliance has been devised and used with complete satisfaction at the Regional Hospital, Fort Monmouth, New Jersey. It is not merely a substitute for the special shoes but in many respect is superior. The device consists of a band of spring steel (bicycle clamp) from which all paint has been removed and to which has been soldered an 8-inch length of flexible chain material obtained from discarded electric fixtures. This appliance is clamped to the bare skin of the lower leg and the chain allowed to drag with 2 inches on the floor. Assuming that the flooring in the operating room is of the conductive type and properly grounded, all potentials being built up on the individual will constantly discharge through the drag chain to the floor.

FIGURE 2

Prior to use, tests were made with a conductivity tester of the electronic bridge type to determine its efficacy. Twenty-five subjects were tested, and all registered more than 1,250,000 ohms, which was as high as

the testing machine could record. After the device was applied, the same subjects were tested again, and the two highest each registered 350,000 ohms. All of the others were much lower, the lowest registering 90,000 ohms. The appliance, therefore, reduced the number of ohms resistance to well below the hazard level. The device is simple to make; the cost is negligible; and observers in the operating rooms can be fitted with one quickly.

MEDICAL AIR EVACUATION IN NEW GUINEA[1]

August 1944

The advanced detachment flew from Nadzab to Biak on 18 August, landing with the troop carrier wing unit and, in the next two days, carved a temporary camp from the thicket. The proposed permanent camp site was 2½ miles west of the farthest infantry outpost and there was no road leading to that area. We will long remember the 41st Division which provided water transportation in "ducks," L.C.M., and L.C.V. to that area. Captain Howard, Captain Wiedeman, Mr. Heckman, the author, and ten men set off up the coast in a "duck" to the spot which in aerial photographs appeared as a likely camp area. With carbines and machetes in hand, we toured the area for two hours, cutting a path through vines and undergrowth, falling into crevices, clambering across coral reefs, brushing off huge ants, panting, soaked with perspiration, and convinced that this was no spot for us. After lunch on cold C rations, we set off in the "duck" looking for a more likely spot and, finding a village built out over the water, climbed the cliff, and came to an open plain. We decided to make this the center of operations and to work out from there to level the jungle, and early each morning our men, Negro troops, and natives went out to the area by barge. An advanced patrol in a "duck" preceded the main body by thirty minutes to make sure that the enemy had set up no ambushes over night and that it was safe to land. Then the "duck" would clamber over the reef separating the barges from the beach and bring in the main group of men. Biak, which is almost on the equator, is no place for hard physical labor. The undergrowth, bound with vines, cut off all circulating air as well as vision. It was a terribly difficult period. To these difficulties, add those of obtaining construction material. Down at Nadzab, we could not draw construction materials because only enough for the base was at hand. At Biak, there was nothing. The materials were in the hands of the base section commander and everything had been frozen for the next move or was allocated to the hospitals expected in the area. We were left with a deadline to meet, 15 September, and no road and no materials with which to construct the camp.

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[1] Condensation of the historical report of a medical air evacuation squadron, July through September 1944, written by Captain Leopold J. Snyder, M.C., squadron historian.

The nurses were finally sent to Hollandia to join their squadron, which took over all evacuation of that base as well as that of Biak, Noemfoor, and Sansapor. We evacuated Wakde, Tadji, Saidor, and Nadzab itself. Our chief sources of patients coming into Nadzab were Tadji, where the "Nips" were still making a futile attempt to push us out of Aitape, and Wakde, the evacuation point for the Sermi-Maffin Bay battle. It was a slow month. Probably when we move to Biak, our period of relative inactivity will end.

Fighting at Aitape once more became desultory as our forces crushed the Japanese attempts to extricate their forces from the Wewak area. With fewer casualties, the need for our personnel to remain there to coordinate air evacuation decreased; so Captain Boileau and his men returned to Nadzab. On the same day we finally were notified that eight of our nurses had received promotions to first lieutenant.

During the month, one nurse and two enlisted men received orders to return to the States. Our personnel have, as a whole, remained well and taken life in New Guinea in stride. The few who have shown signs of "flying fatigue" all had narrow escapes in planes and two were in plane crashes. To preclude a complete breakdown, we requested their return to the States for rest and rehabilitation. Major ——— finally improved enough to allow evacuation by air. We were sorry to lose him, both as a friend and as a man who knew air evacuation thoroughly. A total of 1,721 hours was flown by our personnel this month, considerably less than in previous months. Since combat zones have moved farther north, our personnel accumulated no combat time.

So the month passed with no special problems in air evac-

U. S. Army nurse, Jeanette C. Gleason, Houston, Texas, who bailed out going over the "Hump" and spent four days walking into China. These air ambulances transport patients back to India-based general hospitals. Signal Corps photograph.

uation, sanitation, or squadron health. The food remains good at Nadzab, though much was to be desired in the Biak detachment's food. All personnel wondered what we were to face next. The consensus was that if we were not going home, let us keep moving toward Japan.

September 1944

The whole month of September centered about the labors of our detachment at Biak and the preparation for moving the squadron from Nadzab. The stories of these adventures at Biak will keep many grandchildren wide-eyed for years to come. During the first two weeks we still traveled to our area by barge and "duck." To relate all the incidents connected with this mode of travel would take reams of paper—the "duck" sinking and men swimming to shore, wading to an L.C.M. balanced on a slippery reef, the soldier who slipped off into deep water.

Jondidori, the native village, had been deserted on our arrival, but in a few days the natives returned in full force, the women doing all the work. The young men were usually away hunting Japs, but the old men and children were much in evidence and more than willing to share our C rations. These natives seem more intelligent than those at New Guinea. The children learned English words rapidly and taught our men to count and say certain words of their language. With the impending arrival of the units to be stationed here, we prevailed on the Dutch authorities to move the natives up the coast to the village of Impendi, a mile and one-half away.

When the road was completed, plans were made to move the camp to the permanent area. On the first night in this area, this squadron was the farthest west of any, and our men were living in ward tents just off the trail down which the "Nips" came to the village for food and drink. Mortenson and Patnaude were on guard, sitting back to back to better cover the area and listening to the jungle noises. They heard something unlike normal jungle sounds but waited awhile. Creeping on hands and knees from around a brush pile toward the tents was a Jap. Both started shooting and when the lights were finally turned on this area, the Jap was found dead, thirty feet from the men's tents. In his hand was a grenade. The next day, another Jap walked up to our men's tents waving a white flag, holding his hands in the air and trying to take his clothes off at the same time to show that he was not armed. He seemed happy to tell all he knew about the unit he had deserted five days before. After these episodes, we were given an infantry platoon to take over guard duties.

Slowly the actual building of our area was started. The area apportioned to us was largely a coral reef which the largest bulldozer would hardly budge, and heavy equipment was next to impossible to obtain. With the aid of Major Roberts, the wing air engineer, areas were cleared for the mess

hall and enlisted men's quarters, and with much dynamite and coral fill, a spot for nurses' quarters was leveled at the edge of the cliff overlooking the ocean. Lieutenant Quarantiello at Nadzab was constantly sending the needed supplies and extra men up to me by air; Captain Boileau came up also. Our men could do anything. Carpentering, construction, plumbing, blasting, electric wiring, cement mixing, all found someone able to handle the job. Laying cement until 10 o'clock at night after working all day was accepted as a matter of course. An important boost to all was the arrival of mess personnel, and soon the night work was pleasantly interrupted by coffee and doughtnuts. There was no building so cheerfully and rapidly built as the mess hall. Toward the end of September the advanced detachment of another squadron arrived and was set up just west of us. This outfit had been doing the air evacuation in the Central Pacific for a year or more. We were happy to have them mess with us until they grew too large for our limited facilities.

We have been fortunate, medically speaking, at Biak. We came here fearing especially typhus which was rampant at Owi a few miles away by water. There is scrub typhus on Biak, though it is quite spotty. Strict typhus precautions were adhered to. Leggings and shirts were worn until the area had been cleaned out, burned out, and exposed to the sun for about ten days. Aside from cuts, bruises, and upper respiratory disease, the whole group in the area remained well.

Captain Boileau's purpose in coming to Biak had been to

The two flares (upper left) just fired by this Flying Fortress tell the waiting ambulance men they must be ready to rush its wounded to the base hospital in England. Army Air Forces photograph.

stage here before going on to Morotai which was opening up to troop carrier planes and air evacuation; however, transports did not yet fly to Morotai; so he and his three men settled down to the work at hand, the building of our camp. Meanwhile down at Nadzab preparations were being made for the unit move. Arrangements were made with our Aussie friends, the R.A.A.F. air evacuation squadron, to take over all Nadzab evacuation. When we moved, an Australian field ambulance was to move in and set up a hospital. Much preparation was being made to support the Australian forces which were advancing on Wewak and through the New Britain jungles to take Rabaul. Aussie casualties were to be flown to Nadzab where they would be sorted and those to be returned to duty shortly taken to their general hospital at Lae by ambulance. Those who need long periods of hospitalization are to be flown on A.T.C. ships to Australia, using Aussie air evacuation personnel.

A.T.C. asked our help in evacuating casualties to the States. As the number of patients who must be evacuated by air from New Guinea has reached a considerable proportion, we requested permission to use our personnel for this evacuation, but the Fifth Air Force refused permission on the basis that we would be needed for evacuation from elsewhere. Orders from the Fifth Air Force have been received, requiring our movement by air by the 15th. It is impossible to have our installations ready by that time to house nurses and run the squadron.

In September the squadron did little as far as evacuating casualties is concerned. We continued to evacuate Tadji, Wakde, Nadzab, and Lae, and helped another squadron move 300 patients when they were overloaded at Hollandia. What evacuation we had was shared by the Australian squadron. In all, 1,101 patients were evacuated by air, of whom 957 were medical problems. As usual, a great number were neuropsychiatric problems. Our personnel flew 1,163 hours during the month, but for the second month in a row, they flew to no combat areas.

Although a Medical Department unit, we are unlike hospitals and dispensaries which can consider their patients as medical, surgical, or psychiatric problems. Our association with patients can be divided into two categories. The first is an operation relationship. Our primary mission is to relieve forward medical installations of casualties so that their personnel and supplies will not be overtaxed and thus allow for reception of more acute casualties. We, therefore, arrange for planes to transport patients to the rear, arrange for all communications and ambulance transportation, and keep all hospitals advised of movement of patients, thus preventing the tying up of planes at forward areas waiting for casualties to arrive from hospitals. Our second relationship with patients

is one of nursing while in flight. This relationship occupies only a short time, eight hours or so at the most. Many of our personnel have noted that many asthmatics gain relief at high altitudes, although this does not apply to "cardiac asthma" or emphysema. We have evolved a treatment for air sickness, proved successful by the greatly lessened number of cases that have emesis in contrast to the number during the early months in New Guinea. With the first signs of air sickness, the patient is allowed to recline. A sedative, usually phenobarbital, and a few breaths of oxygen are administered. With these simple procedures, the patient seldom develops the more severe symptoms of air sickness.

Psychotics have been among our great problems. In our opinion sodium amytal is the sedative of choice. In the excited patient, we believe that to induce the smoothest and most effective sedation a 7½-grain ampule should be given intravenously until the patient loses consciousness, and then the remainder given intramuscularly. The intravenous administration should not exceed a rate of 1 cc. a minute. If given more rapidly, the patient may show no effect at first, but after the full ampule is given, he may suddenly fall into a deep narcosis which theoretically is dangerous when flying at low oxygen levels. Once a patient is sedated properly, it is relatively simple to maintain his sedation by oral sodium amytal. It has not been found necessary to use other theoretically safer sedatives, such as chloral hydrate or paraldehyde. Paraldehyde is rapidly breathed off at high altitudes, and the odor is disturbing to other patients in the plane. It is of utmost importance to hydrate thoroughly the manic patient. We have frequently carried patients who have been dangerously dehydrated and this state is still increased by their struggles against restraints during flight. The presence of a nurse in handling the manic patient is of great value. A well-trained nurse often is better able to control such a patient than a medical officer. His fear of airplane travel is allayed by the presence of a woman, a fact true of all male patients.

Sanitation has been no particular problem in Nadzab. Garbage disposal is taken care of by barrel incinerator and soakage pit. At Biak, there should be no added difficulty. The coral soaks up any rain water. A huge crevice behind our mess hall will serve very well as a soakage pit, liquid garbage, of course, going first through a grease trap.

The training of men and nurses continued with talks on malaria and typhus control, physiology of flight, and allied subjects. It is extremely difficult to give formal lectures to our group. Nurses live eight miles away from our installation in Nadzab; in addition, we almost always have detachments off at other bases or personnel caught away from home base after flight. As the last quarter of the year approaches, we look forward to an increased need for our services in air evacuation.

MAJOR GENERAL SHELLEY U. MARIETTA

Major General Shelley U. Marietta, commanding general of the Army Medical Center and of Walter Reed General Hospital, Washington, D. C., was born in Iowa in 1881 and graduated from the Medical Department, University of Illinois, Chicago, in 1909. He was on active duty as first lieutenant, Medical Reserve Corps, March 1910 to March 1911 and from August 1911 to May 1912 when he graduated from the Army Medical School and was commissioned in the Regular Army Medical Corps. He then served at the Presidio of Monterey, California; Fort Bayard, New Mexico; and at Corregidor and Manila in the Philippine Islands, returning to the United States in August 1916, thereafter serving at Corpus Christi and San Antonio, Texas, and as commanding officer, Base Hospital, Camp Gordon, Georgia, until June 1918 when he organized Base Hospital No. 43 and sailed for France, serving as commanding officer of that hospital at Blois; at the Hospital Center, Savenay, France; Headquarters, A.E.F., Tours, France; Headquarters, A.E.F., Antwerp, Belgium, and commanding officer of hospital in Brest, France. In 1919 he served as commanding officer, General Hospital No. 8, Otisville, New York, and in 1920 at Walter Reed General Hospital as assistant to chief of medical service; then assistant chief and chief of the medical service, Fitzsimons General Hospital, Denver; and chief of medical service, Station Hospital, Fort Sam Houston, Texas. For several months he was a student at the Mayo Foundation, Rochester, Minnesota, and from November 1928 to May 1931 was executive officer of the medical service at the Letterman General Hospital, San Francisco. He then became chief of medical service successively at

Major General Shelley U. Marietta

Walter Reed General Hospital, Schofield Barracks and Tripler General Hospital, Hawaii, and the Station Hospital, Fort Sam Houston, Texas. From April to December 1939 he was chief of the medical service, Walter Reed General Hospital, then was appointed Assistant Surgeon General, remaining on duty at that station as commanding general of the hospital. He was appointed commanding general, Army Medical Center, in February 1941, in which position he is still serving. General Marietta was promoted to his present rank 13 September 1943. He was retired for age on 31 January 1945 and returned to active duty the following day. The French Government has awarded him the Order of the University Palm, Grade of Officier d'Academie with Silver Palms.

AWARD OF THE BRONZE STAR MEDAL

The War Department has announced the award of the Bronze Star Medal to the following Medical Department personnel:

Lieutenant Colonel George T. Colvard, M.C., posthumous.
Major Luther C. Heidger, M.C., posthumous.
Major Ralph E. Hibbs, M.C., Oskaloosa, Iowa.
Major Charles J. Katz, M.C., Oak Park, Illinois.
Major Fred G. Nasr (then captain), D.C., Omaha, Nebraska.
Major Denton J. Rees, D.C., Oregon City, Oregon.
Major William P. Rhudy, M.C., Penn Yan, New York.
Major Earl C. Ritter (then captain), V.C., Sumner, Iowa.
Major Jay E. Tremaine, M.C., posthumous.
Captain Robert Blatherwick, M.C., Van Hook, North Dakota.
Captain Harry M. Brown (then first lieutenant), M.C., Cicero, Indiana.
Captain Floyd M. Burgeson, M.C., Des Moines, Iowa.
Captain Karl J. Chiapella, M.C., of Chico, California.
Captain Claude P. Daniel (then first lieutenant), D.C., Bogalusa, Louisiana.
Captain Mark W. Dick, M.C., of Grand Rapids, Michigan.
Captain Cecil J. Hawes, M.C., Conway, South Carolina.
Captain Edward J. Horodko, M.C., of Chicago, Illinois.
Captain William E. Johnson, D.C., Ripley, Mississippi (also awarded Oak-Leaf Cluster to Bronze Star Medal).
Captain Charles F. Lewis, M.C., Oakland, California.
Captain Roscoe I. McFadden, M.C., of Madison College, Tennessee.
Captain Tandy G. Morris, Jr., M.C., Jackson, Tennessee.
Captain Merle M. Musselman, M.C., Tucson, Arizona.
Captain Mark M. Pomaranc, M.C., of Chicago, Illinois.
Captain Ruth C. Tubergen, A.N.C., Elmhurst, Illinois.
Chief Warrant Officer Frank D. Fischer, New York City.
Master Sergeant Stanley F. Wallace, Sikeston, Missouri.
Technical Sergeant Milo J. Folsom, Dubuque, Iowa.
Technical Sergeant Roy A. Gatewood, Elijah, Missouri.
Technical Sergeant George J. Gavin, Dubuque, Iowa.
Technical Sergeant Darvin O. Patrick, Hummelstown, Pennsylvania.
Technical Sergeant Harry J. Staples, Binghamton, New York.
Staff Sergeant Harold M. Amos, Afton, Iowa.
Staff Sergeant Chester J. Brown, Trenton, Mississippi.
Staff Sergeant Roger D. Campbell, Albuquerque, New Mexico.
Staff Sergeant Leonard A. Gibbs, Willis, Texas.
Staff Sergeant Grandison N. Vroman, Delanson, New York.
Staff Sergeant Gerald W. Wagner, Rapid City, South Dakota.
Sergeant Frank C. Potyraj, Grand Rapids, Michigan.
Corporal Paul M. Browning, Princeton, New Jersey.
Corporal Eugene C. Clark, Lincoln, Nebraska.
Corporal Eugene H. Evers, Dyersville, Iowa.
Corporal Lawrence C. Hill, Jellico, Tennessee.
Corporal Loyd A. Jackson, Holcomb, Missouri.
Private Irving Kaplan, Chicago.
Corporal George McHale, East St. Louis, Illinois.
Private First Class John A. Moores, Woodbine, Iowa.
Private First Class Don E. Robertson, Ardmore, Oklahoma.
Private First Class Ralph Rodriguez, Bernalillo, New Mexico.
Private First Class Joseph B. C. Thibeault, Lawrence, Massachusetts.
Private Espiridion Archibeque, Albuquerque, New Mexico.

AWARD OF THE SILVER STAR

The War Department has announced the award of the Silver Star to the following Medical Department personnel:

Major Martin R. Wisely, M.C., of Edenton, North Carolina.
Captain Walter E. Block, M.C., of Chicago, Illinois.
Captain Albert H. Braden, Jr., M.C., of Houston, Texas.
Captain John Graziano, D.C., of Brooklyn, New York.
Captain Carl W. Hammer, M.C., of Oxford, Michigan.
Captain John H. Kilmer, M.C., of Fort Wayne, Indiana.
Captain Edward I. Lederman, M.C., of Baltimore, Maryland.
Captan Mitchel Sack., D.C., of Central Falls, Rhode Island.
Captain Roger E. Watson, M.C., of Perrysburg, Ohio.
First Lieut. Ralph P. Baldini, D.C.
Technician Third Grade Earl E. Bailey, of Framingham, Massachusetts (with Oak-Leaf Cluster).
Technician Third Grade Leroy E. Wilde, posthumous (with Oak-Leaf Cluster).
Technician Fourth Grade Val J. Roberts, of Fort Worth, Texas.
Technician Fifth Grade Woodrow L. Kelley, of Milford, Texas.
Private First Class Oscar W. Cox, of Breckenridge, Texas.

LEGION OF MERIT

The War Department has announced the award of the Legion of Merit to the following Medical Department personnel:

Brigadier General Roy C. Heflebower, U. S. Army, Washington, D. C.
Brigadier General Charles C. Hillman, U. S. Army, Almyra, Arkansas.
Brigadier General Royal Reynolds, U. S. Army, West Point, New York.
Colonel Robert F. Bradish, M.C., New Orleans, Louisiana.
Colonel Bradley L. Coley, M.C., New York.
Colonel Gerald W. FitzGerald, V.C., Roswell, New Mexico.
Colonel John C. Fitzpatrick, M.C., Chicago, Illinois.
Colonel Wilford F. Hall, M.C., Bridgeport, Connecticut.
Colonel Ira V. Hiscock, Sn.C., New Haven, Connecticut.
Colonel Albert H. Schwichtenberg, M.C., Portland, Oregon.
Colonel Achilles L. Tynes, M.C., Washington, D. C.
Colonel Arthur B. Welsh, M.C., Washington, D. C.
Lieutenant Colonel R. Robert Cohen, M.C., Pittsburgh, Pennsylvania.
Lieutenant Colonel William S. Moore, M.C., Washington, D. C.
Lieutenant Colonel Frederic N. Schwartz, M.C., Chestnut Hill, Massachusetts.

DISTINGUISHED SERVICE MEDAL

The War Department has announced the award of the Distinguished Service Medal to the following Medical Department personnel:

Major General George C. Dunham, U. S. Army, Washington, D. C.
Major General Albert W. Kenner, U. S. Army, Washington, D. C. (Oak-Leaf Cluster).
Brigadier General Joseph I. Martin, U. S. Army, Rockford, Illinois.
Brigadier General John A. Rogers, U. S. Army, Washington, D. C.

RECENT DIRECTIVES AND PUBLICATIONS

This list is intended as only a brief reference to the items mentioned. Before acting on any of them, the original communication should be read, and requests for copies, when made, should be directed to the source of the communication through proper channels.

WD Circular No. 188 23 June 45	Separation Centers. Sets forth detailed regulations governing (1) operation of separation centers; (2) categories of personnel not to be sent to such centers; (3) responsibilities of separation centers.
WD Circular No. 194 28 June 45	Officers Reserve Corps. Announces establishment of certain new sections of O.R.C., which includes establishment of Pharmacy Corps Reserve. Provides that all officers in A.U.S. will be offered appointments in O.R.C. when relieved from active duty. Such appointments to be handled in accordance with instructions set forth.
WD Circular No. 198 30 June 45 Sect. I	Disease. Gives detailed instruction to commanding officers of oversea theaters re precautions to control entry and prevent spread of infectious and parasitic diseases incident to the movement of troops located outside U. S.
ASF, Headquarters Circular No. 260 6 July 45 Part II, Sect. I	Prisoners of War. Provides that Article 31 of Geneva Convention, re work relating to war operations, is no longer applicable to Italian and German prisoners of war, but remains applicable to Japanese prisoners of war.
ASF, Headquarters Circular No. 263 10 July 45 Part II, Sect. III	Immunization Register. Provides that reception centers will use W.D., A.G.O. Form No. 8-117, Immunization Register and Other Data, instead of W.D., M.D. Form No. 81. Foregoing is in compliance with paragraph 2a, AR 40-215, and TM 12-223.
ASF, Headquarters Circular No. 263 10 July 45 Part II, Sect. XI	Prisoners of War. Personnel used as guards for prisoners of war will be screened carefully before assignment to that duty, and individuals whose medical history indicates any type of psychoneurosis or psychosis will not be assigned to that duty. Individuals presently used having such medical history will be relieved immediately.
WD Circular No. 207 10 July 45 Sect. VI	DDT. Airplane Spraying. Mosquito and insect control projects which involve airplane application of DDT in U. S. must be approved by the Army Committee for Insect and Rodent Control, Surgeon General's Office. Sets forth instructions re submission of requests for approval of such projects.
WD Circular No. 208 12 July 45 Sect. XI	Tax. Officers' Clubs and Messes. Secretary of Treasury has ruled that commissioned officers' clubs and messes operated pursuant to AR 210-50 are considered as wholly owned instrumentalities of U. S. with respect to operations on and after 20 Jan. 1945. Accordingly, such clubs and messes are not required to pay Federal old-age and employment taxes, state unemployment taxes, nor contributions with respect to wages paid to employees.
WD Circular No. 209 13 July 45 Sect. VII	Syphilis. To improve quality of serodiagnostic tests for syphilis employed by Army laboratories and to provide uniformity in procedures used, laboratories will secure from the Army Medical School certain standardized reagents for the Kahn and Kolmer serodiagnostic tests.
ASF, Headquarters Circular No. 270 14 July 45 Part II, Sect. VI	Records of each patient transferred from ZI medical installation to a convalescent hospital will contain: (1) summary of patient's hospital treatment; and (2) recommendations as to future treatment and final disposition.

Airborne division advances in snowstorm behind tanks to attack Herresboch, Belgium. 28 January 1945. Signal Corps photograph.

Litter bearers carry wounded infantryman over the crest of an Italian mountain. First Battalion, 80th Mountain Infantry, 10th Mountain Division. 20 February 1945.

"Medics" of a portable surgical hospital drying their clothes after a rainy night in foxholes, at first-aid station 2 miles from the front lines. New Guinea. 26 April 1944. Signal Corps photograph.

Behind the lines on Okinawa, Marines of the Fourth Marine Regiment sun-bathe while enjoying chocolate-covered doughnuts which three of their buddies prepared. U. S. Marine Corps photograph.

Vol. IV
No. 5

Special Articles

The Prevention of Dengue Fever

Recent experimental proof that *Aedes scutellaris* may transmit dengue and the use of DDT for the control of mosquitoes necessitate some revision in the methods of prevention and control of this disease which, from a military viewpoint, is formidable.

Dengue is transmitted to man by the bites of a few species of mosquitoes. The principal vector is *Aedes aegypti* Linn. which has a more or less world-wide distribution in inhabited areas. *Aedes albopictus* Sk. and, more recently, *Aedes scutellaris* Walk. have been incriminated as vectors in the Pacific-Asiatic area. In Formosa, *Armigeres obturbans* Walk. has been reported to be capable of transmitting dengue experimentally. The demonstration that *A. scutellaris* is a vector of dengue explains the outbreaks which have occurred in jungle areas in the absence of *Aedes aegypti*. The mosquitoes can acquire infection only by feeding on individuals with the disease during the first three or four days of the febrile attack. They become infective for man following an incubation period of eight to eleven or more days. Once a mosquito becomes infective, it remains so during the remainder of its life. Transmission of the virus in the mosquito from one generation to the next through the egg has not been demonstrated.

Aedes aegypti shows a definite preference for breeding in relatively clean water in artificial containers about habitations. Some of the common breeding places are rain barrels, fire barrels, tubs, tanks, cisterns, watering troughs, wells, fish ponds, tin cans, bottles, flower vases, pots, roof gutters, eaves, water-collecting plants, holes in rocks, tree holes, shell cases, wooden boxes, discarded tire casings, wash racks, sumps in garages, tops of oil drums, stored vehicles, canvas tarpaulins, and occasionally semipermanent rain pools, slit trenches, and similar sites which may hold water for about a week or more. Eggs deposited in such locations may remain viable in a dry state for several weeks or months and then hatch following submersion. The adults frequent human habitations. Their flight range is limited to a few hundred yards. *Aedes albopictus*, which has somewhat the same habits as *Aedes aegypti*, is semidomesticated and a common invader of houses. The larvae are found in tree holes and rock holes in the vicinity of human dwellings, and occasionally in old

From the Tropical Disease Control Division, Preventive Medicine Service, Surgeon General's Office.

tins and other containers. Both species bite freely during the day as well as at night.

In its normal breeding grounds, *Aedes scutellaris* larvae breed in fairly clean rain water in coconut shells, tree holes, axils of limbs of mango trees, fallen fronds of coconut and breadfruit trees, and in water containers around native huts. After the area is occupied by troops, breeding rapidly extends to rusty tins, tops of oil drums, tarpaulins, and to discarded equipment of all sorts which may hold water. The adult females of *A. scutellaris* appear to enter habitations only to feed and leave soon after they have engorged. They enter huts and tents chiefly in the early morning and late afternoon. On overcast days, they may bite throughout the day. During the day they rest in cool, damp, well-shaded sites under growing shrubs and bushes. They are abundant in untended coconut groves. Their flight range appears to be limited to about 200 yards.

The prevention of dengue depends primarily on control of the mosquito vectors of the disease and on protection from their bites. A vigorous organized campaign should be conducted for the complete suppression of the mosquito vectors. All feasible and practicable mosquito control measures (TB MEDs 14, 110, 164, and 194, and FM 21-10) should be carried out. Malaria survey units are organized and trained to determine the exact nature of mosquito problems. Malaria control units, sanitary companies or platoons, and unit malaria control details are equipped to execute the necessary mosquito control measures. These organizations and unit details should be used fully to control dengue vectors in areas where the disease is a hazard.

To locate all sources of *Aedes* mosquito breeding, the entire camp or area should be thoroughly and systematically canvassed. Anything which will hold water for about a week or more may be regarded with suspicion. Particular emphasis should be placed on the removal of all unnecessary containers which constitute actual or potential sources of *Aedes* breeding; thorough policing and inspection of camp sites and their environs should be conducted routinely to ensure their prompt removal. For proper disposal, all tin cans must be flattened and buried. Stack oil drums on the side to prevent collection of water on the tops. All tree holes should be filled, and holes in rocks drained, filled, or larvicided, as indicated. Tires should be emptied of water, properly stacked, and covered with tarpaulins when stored out-of-doors. Stored vehicles in open depots should be checked to assure drainage of rain water. Tarpaulins placed over stored supplies should be elevated in the center and stretched tightly at the sides to provide complete drainage. Remove or cut plants in which water may collect. Keep eaves and roof gutters free of debris to provide proper drainage. Inspect the interior of habitations for possible *aegypti* breeding places, such as the water in flower containers. In the case of *Aedes scutellaris*, disposal of tins and water-holding rubbish must be supplemented by the

removal of all fallen coconuts and by the elimination or treatment of natural breeding sites, such as tree holes and the axils of limbs of trees in which water collects. The latter sites may be filled, drained, removed, or larvicided, as indicated.

Larvicide, DDT, powder, dusting (Quartermaster Stock No. 51-L-122), and 5 percent DDT in kerosene or Diesel oil are particularly valuable and suitable for the control of mosquito breeding in artificial containers, except for those used to store water for drinking or cooking. The DDT powder should be applied full-strength (10 percent DDT). A sufficient quantity of either the DDT oil solution or of the DDT powder to give good coverage will provide control of mosquito breeding in relatively clean artificial containers for several weeks, provided the toxicant is not removed. Dosage and interval between routine application of the larvicide should be based upon local experience of the duration of effectiveness. When available, DDT emulsion can be used effectively to control mosquito-breeding in containers. Natives frequently remove the surface film immediately after the application of kerosene or other larvicides to water containers, often necessitating routine emptying of such containers at weekly intervals to prevent continuous breeding. The introduction of larva-eating fish, such as Gambusia, will often successfully control mosquito breeding in cisterns, wells, watering troughs, garden pools, and other sites. Sea water has been used instead of fresh water in fire barrels to prevent breeding in these containers.

Cisterns should be covered and screened to prevent access of mosquitoes to the water and, where necessary, they should be larvicided routinely. Mosquito breeding in cisterns may be abated by the use of kerosene, applied very lightly as a fine spray. This can be used without danger of an objectionable taste in the water, if the outlet is below the water surface. DDT powder or DDT oil solutions must not be used to larvicide cisterns, wells, or other drinking water containers.

Control measures designed to eliminate adult mosquitoes should be carried out intensively in conjunction with antilarval measures. Reduction of the adult insects and protection from their bites are particularly important when an outbreak of dengue exists or threatens, since the generation of adult mosquitoes present at the time, many of which may be infective, constitutes the immediate source of danger.

The use of DDT to kill adult mosquitoes is considered in detail in War Department Technical Bulletin TB MED 110, 25 October 1944. The application of Insecticide, spray, DDT, residual effect (Q.M. No. 51-I-305) to the interior of quarters and to the screens is an extremely valuable measure. Mosquito bars may also be impregnated with DDT as an adjunct control measure. Area spraying of vegetation with 5 percent DDT in petroleum oils has not only a direct killing effect on adult mosquitoes pres-

ent at the time of application, but also may exert residual action on insects that later fly into and rest in treated areas. The degree of residual action will depend largely on the dosage of DDT applied and on weathering factors. Barrier zones may be established around bivouac areas, observation posts, and outdoor gathering places such as open-air theaters, by spraying vegetation within a radius extending at least 10 yards beyond the boundary of the area to be protected. Application should be in dosages up to 5 gallons per acre, spraying at waist height with a power or knapsack sprayer. When circumstances permit, the adult mosquitoes may be attacked by clearing vegetation, underbrush, and shelters for a zone of about 200 yards around camps, thus eliminating many of the resting places of the adults.

For large-scale area control of mosquitoes, specially equipped aircraft may be employed to spray oil solutions of DDT. This method has been used with dramatic success to bring dengue epidemics under rapid control. In the face of an outbreak of dengue, or where it represents a potential threat in military operations, the distribution of DDT spray by aircraft constitutes an effective weapon for the prevention and control of dengue through its ability to reduce immediately the infected adult mosquito population. Spray reaching breeding sites also kills the larval forms. The dispersal of DDT by aircraft should supplement, not replace, standard ground measures of mosquito control.

Screen wire of U. S. standard 18-mesh is required to exclude *Aedes aegypti.* Thorough mosquito-proofing of working, sleeping, and all hospital quarters with suitable screening or netting should be effected whenever practicable.

The adequate disinsection of aircraft and ships is necessary to prevent the transportation of dengue vectors from one area to another. The insecticide aerosol dispenser is convenient and extremely suitable for disinsecting the interior of aircraft and ships. Measures should be taken to prevent or eliminate larval breeding of *Aedes* mosquitoes on ships in containers or stored cargo, such as salvaged tires. Articles which collect rain water should be emptied and covered. Washing down with sea water is practiced to eliminate larval breeding in water catchments on shipboard.

Since dengue vectors may feed both during the day and at night, individual protective measures against their bites must be used at all times. Long-sleeved shirts and full-length trousers should be worn during the day and in the evening, until retiring under the protection of mosquito bars or screens. The wearing of leggings to prevent bites about the ankle, a favorite feeding site, is advised. Insect repellent (Q.M. No. 51-R-265) should be applied to exposed portions of the skin repeatedly during the day and in the evening. This repellent should also be applied liberally to areas of the clothing (e.g., elbows, shoulders, seat, knees, and ankles) where insects may bite through. Careful supervision is required to ensure the full and proper use of repellents. Rou-

tine spraying of both working and sleeping quarters with the Insecticide, aerosol, 1-pound dispenser ("aerosol bomb"—Q.M. No. 51-I-159) or Insecticide, liquid, finished spray (Q.M. No. 51-I-169) during the day and the evening affords considerable protection. All personnel should be required to sleep under mosquito bars when not protected by adequate screening. Head nets and gloves afford good protection from mosquito bites and may be used where mosquitoes are numerous, so far as they do not interfere with the performance of duties.

The segregation of troops from sources of infection is an important preventive measure. When practicable, troops should be kept away from local areas where the disease is occurring. It is advisable to locate camp sites, whenever possible, at least a mile from civilian or native habitations. Individuals or patients suffering from dengue must be kept under mosquito bars during the febrile stage of the disease (for at least four days from the onset of symptoms) to prevent their serving as a source of infection for mosquitoes. No animal reservoir of the disease has been demonstrated.

An Italian P.O.W. gang working in the Algiers area, North Africa, on minor clearing and canalization for malaria control. 21 September 1943. Signal Corps photograph.

Medical Education in Germany

Medical schools. To obtain a picture of medical education in Germany during the war years, visits were made to the Universities of Jena, Leipzig, and Halle, where faculty members were interviewed. At Jena, the preclinical buildings had been badly bombed, but the hospital clinics suffered little, a number of bombproof buildings having been built in 1942. The surgical building had one and one-half stories under ground, two stories above ground, an independent water supply, electrical supply, and heating, and was air-conditioned. It would accommodate about 150 patients. At Leipzig, there was extensive damage. Out of 1,000 beds in the medical clinic, about 650 were destroyed. The laboratory and x-ray sections were completely destroyed. While the various clinics at the University of Halle were moderately damaged, only about 150 beds of a total of about 2,000 were destroyed.

During the war, the length of the medical course was reduced from twelve semesters (six years) to ten semesters, and in April of 1945 to nine semesters. There were about 2,500 students at Jena, 1,500 at Leipzig, and 700 at Halle. The caliber of the medical students is below the peacetime level, because many of the students come directly into school from the Army without proper background or aptitude and because of general hardships and interference brought on by the war. Students had many interruptions associated with military training in addition to having the course cut down from six years to four and one-half years. When military duties were excluded, the total time spent in the University was in reality limited to about three and one-half years.

During the war there were four sources for obtaining medical students: (1) The largest group was drawn from physically fit men who were part of the so-called Student Combatant Corps, under the direction of the Army; they wore a uniform and were committed to the Army while at school and at the end of their studies. Many of the students in this group had apparently been selected at random by the Army and sent to study medicine; also in this group were many who asked to be sent to study medicine merely to avoid duty at the front. The complete tuition of these men was paid by the state. (2) A smaller group consisted of soldiers discharged from the services because of general physical disability or for other reasons. The state paid for their education and, after completing their studies, they were assigned by the state either to

Much of this material is from a report by Colonel Robert M. Zollinger, M.C.; Colonel Francois H. K. Reynolds, V.C.; Lieut. Colonel George F. Jeffcott, D.C.; and Captain Hans Schlumberger, M.C.

civilian or state military hospitals. (3) The third group consisted of those unfit for military service and a few excused from military service because they showed a particular aptitude for the study of medicine. These students paid their own tuition. After completing their studies they were assigned by the state to civilian hospitals or were trained as specialists. (4) An increasing number of women were admitted to the universities to study medicine. These students paid their own tuition and after completion of studies were assigned to civilian hospitals; a few were trained as specialists.

Crowding of classes resulted from destruction of university buildings, assistants were decreased by about 50 percent, and classwork was further disrupted by bombings and alerts. As the number of assistants decreased and the civilian patient load was heavy, it was impossible for the teachers to instruct classes as thoroughly as in peacetime. Ordinarily, in peacetime, professors of medicine and surgery each had about 20 to 40 assistants who were trained from four to ten years in their respective specialties. Assistants were paid 5,000 to 7,000 marks yearly, depending on length of service. At least one of these assistants was used in the private clinic of the professor for a period of one year. Occasionally, the professor would arrange for the assistant to increase his income by caring for semiprivate patients in the clinic and also by the filling out of insurance reports and papers.

During peacetime and early in the war, at least two Army medical officers were sent to each clinic for further study in surgery and medicine. Before the end of the war the number of Army doctors sent and the time spent in the clinics were variable. These men were assigned by the Army, and the number and types of students were not controlled by the professors.

A student wishing to continue postgraduate study applied to the professor of his choice. If accepted by the professor, he had to apply to the Army to be released for further study, and also had to be cleared by the Ministry of Education. Apparently, the physically unfit and the women could take postgraduate study if they were acceptable to the professor, without having to apply to the Ministry of Education. The number of male students allowed for postgraduate study was apparently so limited that it was necessary for the professors to accept a number of women for training each year. All of the professors showed a decided lack of enthusiasm for training women in the specialties.

A minimum of four years was required, at least in surgery, before the professor issued a certificate to the student stating that he was qualified in the respective specialty. The student also had to pass an examination. Students showing special ability might be retained as long as ten years as assistant professors, but eventually they were appointed professors in other universities. Students not retained for prolonged training

might be assigned to civilian clinics. The professors issued a certificate stating that the student had passed examinations in the specialty. This certificate was registered by a central board in Berlin; the board merely registered the certificate given by the professor, but did not give a further examination.

The University of Erlangen had an intact plant, and though many of the younger instructors are in the German Army, the heads of the departments are still at their posts. The University Hospital is fairly well staffed and has suffered no damage.

The following general conclusions are drawn: It is doubtful if any significant new developments have been made in medical or surgical research. The surgical equipment was of prewar standard.

Advances were not noted in surgical treatment, although sound surgical principles of prewar standard were generally adhered to. Chemotherapy in the form of various sulfonamides was widely used, and in some instances in dosages considerably greater than those used in the U. S. Army. The attitude as to its effectiveness was consistent with that of the U. S. Army. Penicillin was not available.

There was a lack of appreciation of the actual requirements for blood and plasma in the treatment of shock and burns. Blood banks were not utilized, although fresh whole blood was used liberally.

Standards of medical practice in Germany will undoubtedly show for years the deteriorating effects of war. There will be a marked deficiency in well-qualified specialists and teachers. The heads of departments at Jena and Leipzig appeared to be of high caliber and will continue to be the nucleus for high standards of medical education when and if the proper opportunities arise.

Dental education. Most dental schools in Germany functioned with increasing difficulty up to the spring of 1945. Damage to buildings and equipment will run from 60 percent (Halle) to 90 percent (Jena). All universities visited were damaged. Staffs have been scattered. School authorities are anxious to resume teaching. Dental education was hampered by political interference with universities long before the war; the war damage has only served to accentuate the decline of German dentistry, which probably began with World War I.

Dental education received severe setbacks during the war. With mobilization, all schools for *Dentisten* were closed for the duration. All physically qualified males were taken from the schools for *Zahnärzte* early in the mobilization period and did not begin to return until 1941, when it became apparent that Germany's hope of a short war would not materialize and that she must give consideration to a long-term health program for the nation. Even then, when the Army returned selected former students, paying their salary as noncommissioned officers but paying no school expenses, the total enrollment remained

about half its peacetime figure. Between two-thirds and three-fourths of the wartime students were women. While the length of the course has not been reduced from the three and one-half years prewar level, other factors have reduced the available time for study. The total number of students graduating each year is not known, but it is estimated about 500 new students enter each year.

Socialized dentistry. In Germany very little practice is done on a straight fee basis. Roughly two-thirds of all dental treatment is accomplished under the state insurance system. Dental attention is limited to essential procedure with cheapest materials provided. About one-third, for persons not eligible for insurance or for those desiring better treatment, is handled by private insurance systems. These may provide very cheap or very elaborate service, and fees, therefore, vary in different insurance organizations. It is believed the state insurance system pays so little that dentists must handle too many cases, men dependent on this type of practice often working a crowded nine-hour day to make a living. The service rendered is not good but is probably the best the laborer can afford. Those patients who can afford it belong to private insurance groups.

Military dentistry. Before the war, there was no Dental Corps in the German Army, based on the reasoning that in a short blitzkrieg no dentists would be needed. Soon after mobilization in 1939, dentists already in the Army as line troops, or entering later, were given a noncommissioned rating somewhat similar to that of a contract surgeon. They wore the uniform of officers and were given relative rank and pay of major or lieutenant colonel, depending on age and professional standing.

Replacement was authorized for any tooth lost in combat or as a result of duties as a soldier. Other replacements were made when the patient had an insufficient number of teeth. The requirement was extremely low and in most cases was left up to the judgment of the dental officer. Patients could not refuse treatment of conditions which affected their military efficiency.

Veterinary training. All veterinary matters in Thuringia were administered from the University of Jena, where students of agriculture are trained, but it does not confer degrees in veterinary medicine. Students must have two years of practical work on a farm and the course at the Institute takes three years. To receive the degree of Doctor of Agriculture, students must continue for one or two additional semesters and prepare a thesis on a research problem. While classes formerly averaged about thirty students, there has been no teaching since 1939.

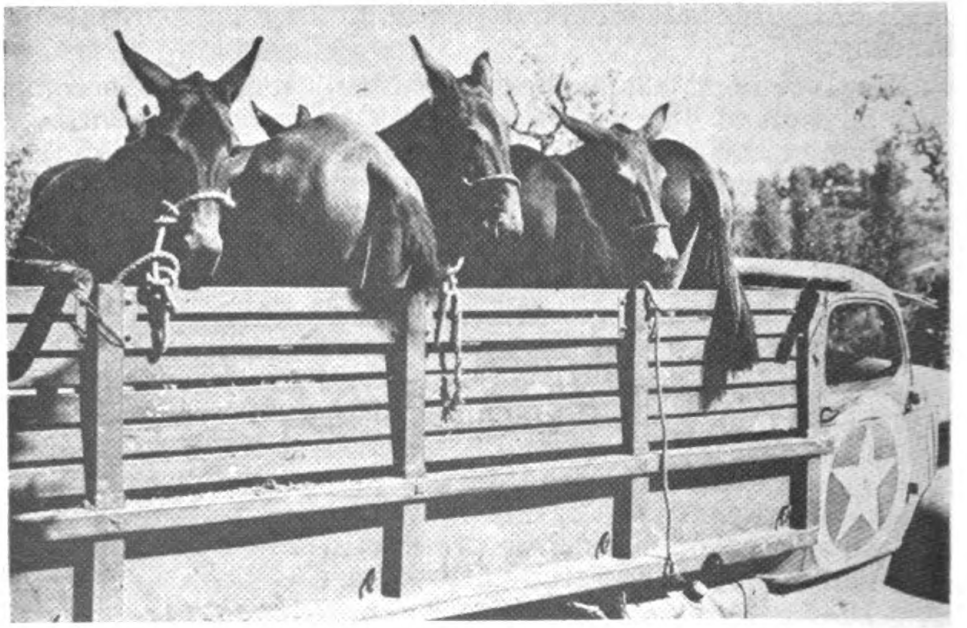
The Veterinary Institute at Halle was similar to other such institutions in Germany. At the University of Leipzig, as a

result of bombing, little was left of the Veterinary Institute. Students received a diploma to practice after successful completion of four and one-half years. The degree of Doctor of Veterinary Medicine was granted if the student carried out a research project on which he wrote his thesis, requiring an additional period of work ranging from six months to one year.

The Institute of Pharmacy and Food Chemistry at the University of Jena was concerned with the chemistry of food and drugs but had not been in operation for some time because of the damage from bombs. The work on food products was akin to that of the Army laboratories, although no bacteriologic analyses were carried out.

In addition, the Institute gives a course in materia medica and conducts research. Students specializing in this subject receive the degree of Doctor of Natural Sciences after completing the ordinary three-year course, after which they take advanced training for two to four semesters. Students who successfully complete the ordinary three-year course are graduated as druggists.

Lectures at Institute of Pathology.—Professor Frank G. H. Haughwout, formerly chief, Section of Parasitology and Cellular Pathology, Bureau of Science, Manila, and Professor of Protozoology, Graduate School of Tropical Medicine and Public Health, University of the Philippines. discussed "The Differential Diagnosis of Alvine Fluxes Based on Experiences in Civilian Prison Camps of the Philippines" in three lectures at the Army Institute of Pathology, Washington, D. C., on 12, 17, and 21 September. Throughout World War II, Professor Haughwout was in charge of the intestinal disease clinics of the civilian prison camps in the Philippines.



Mules *en route* to the front. **Fifth Army, Scarperia, Italy, 27 September 1944. Signal Corps photograph.**

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Original Articles

Psychosomatic Medicine on General Medical Wards

BRIGADIER GENERAL WILLIAM C. MENNINGER
United States Army

When one speaks of psychosomatic medicine, he may refer to several different concepts. I like to think of psychosomatic as a term which applies to a point of view of all medicine, to all illness. I should like to believe that every physician has a psychosomatic point of view whether he is a surgeon, an internist, or a psychiatrist. I should like to believe that the recent emphasis on the term might indicate reawakening of an interest in the sick person and not merely his disease, that it is an awareness that the man's strivings, loves, hates, successes, and failures may have more to do with the way he may feel than bacteria or bullets. Finally, I would like to believe that it is a re-emphasis of a method of study in which there is no less study of the soma but much more study of the psyche and its influence in producing ill health along with methods that physicians can use in the treatment of every patient.

Psychosomatic medicine for some people refers to a few borderline conditions in which there is a very major emphasis of the emotional factor in their causation. This group, the organ neuroses, about which I wish to speak, might be rigidly classified either as belonging in the field of psychiatry or of internal medicine. For the most part, they can and should be handled on the general medical wards of Army hospitals by the internist.

A recent survey from eleven general hospitals in the zone of the interior indicated that 24.2 percent of the patients on the cardiovascular wards were functional and that 20.7 percent of the cases on the gastrointestinal wards were functional. In a station hospital, these figures rose to 41 percent of the cardiovascular cases and 30 percent of the gastrointestinal cases, and all these data were supplied by internists. One should keep in mind that the patients in general hospitals represent a fairly well-sifted group. Undoubtedly the percentage of such problems in the dispensary would be much higher. It is not surprising, from a psychiatric point of view, that these figures should be so large, and one may even question why they are not higher; a survey by or with a psychiatrist would have given higher figures.

Presented at the conference of Service Command and Civilian Consultants in Medicine, Atlantic City, 4 August 1945.

The significance in these figures lies in the fact that too few physicians have sufficient scientific understanding of these illnesses to adequately diagnose or treat them. It requires more than the influence of Virchow to explain this curious state in medical practice. It is due, in part, to our medical education which stressed anatomy, physiology, and pathology of the soma, but left us embarrassingly ignorant of the anatomy, physiology, and pathology of the psyche.

The whole problem is intimately tied up with the delayed development of a usable body of scientific knowledge about the person, the individual that lives in the soma, thus tending to limit our interest to the specific somatic expressions of that person. This deficiency, due to many causes, becomes of more importance in the Army than in civilian life. Even a minor incapacity of a soldier calls for his hospitalization. The emergency calls for his prompt return to effective duty, and in every case this means a return to the special physical and emotional stresses inherent in the Army. This contrast has been aptly phrased for much of Army psychiatry: in civilian practice the physician is concerned with the reaction of abnormal persons to normal situations; in the military, he is concerned with the reaction of normal persons to abnormal situations. So far as these reactions involve viscera, and most of them do, they enter the domain of internal medicine. Consequently, it is stimulating to have an opportunity to discuss with a group of the leading internists of military and civilian life the implications for diagnosis and treatment of that group of illnesses in which the organs of the body act as mirrors for the emotional maladjustments of the individual.

TYPES OF PROBLEMS

Because of the necessity to limit the scope of the subject, consideration will not be given here to emotional factors in physical disease—e.g., the anxiety of anginal attacks, the delirium of febrile disease, and all the wide gamut of emotional response to organic illness. Their omission here is not to be interpreted as indicating their lesser importance. It is essential that they should be the object of special study and therapeutic effort of the physician in charge. On the other hand, there are four general groups of emotional expressions using bodily systems which repeatedly and continuously come under the scrutiny of the internist—the cardiovascular, the gastrointestinal, the great group of aches and pains included in the cephalalgias, arthralgias, and myalgias, and lastly the allergies.

Cardiovascular disease has as its five most common symptoms pain, shortness of breath, palpitation, murmur, and fatigue, all of which may be the expression of emotionally disordered, as well as organic, heart disease. No other body system is used so frequently in its symbolic sense to refer to love and to hate, which parenthetically should point out to us, at

least, one lead as to the emotional significance of disturbances involving the heart. As a symbol of affection, we are familiar with the universal use of the heart as a valentine, the colloquial expression of "loving with all my heart," "a warm heart," "heart throbs," "heartfelt." For the individual whose capacity to love is questioned, we have such terms as "fainthearted," "chickenhearted," "thin blooded." We have words indicating the lack of love or the expression of hate in such words as "hardhearted," "cold blooded," "heartless," "heart rending." We speak of one being "heartsick" or having a "heartache." Most physicians have observed that individuals will receive the news that they have damaged kidneys with much more equanimity than the information that their hearts are not functioning properly. Certainly one can conclude, on the basis of clinical experience, that every disorder of the heart has a peculiar and often an exaggerated emotional response and that many heart difficulties have their entire basis of origin on emotional disturbances.

Similarly, the gastrointestinal tract presents a wide variety of functional disturbances and, in general, probably lends itself to mirror the emotions better than any other body system. This may be, in part, because it is partially under voluntary control. Next to the skin, the gastrointestinal system has more contact with the external world than any other part of the personality. It receives more direct demands for adjustment and accommodation, more insults and abuses, and a greater variety of opportunities for gratification than any other set of organs suffers or enjoys. Such disturbances occur in all of us and in some, all too frequently.

Perhaps because of their organic interests, their enthusiam for pathology, too many physicians ignore these basic facts. Crookshank expressed this paradox in medical attitude by stating: "It always seemed to me odd in the extreme that doctors, who, when students, suffered with frequency of micturition before an examination, or, when in France, had actual experiences of the bowel looseness that occurred before action, should persistently refuse to seek a psychological correlative—not to say an etiological factor—when confronted with a case of functional enuresis or mucous colitis. I often wonder that some hard-boiled and orthodox clinician does not describe emotional weeping as a new disease, calling it paroxysmal lacrimation and suggesting treatment by belladonna, astringent, local application, avoidance of sexual excess, tea, tobacco and alcohol, and a salt-free diet with restriction of fluid intake; proceeding, in the event of failure, to early removal of the tear glands. Of course, this sounds ludicrous, but a good deal of contemporary medicine and surgery seems to me to be on much the same level." It is encouraging to see the increasing emphasis placed on the emotional factors in these conditions, as exemplified by such gastroenterologists as

Alverez and Palmer, the latter having described certain individuals as having a "barometric abdomen," and in these individuals it is only an indication of the total personality functioning.

As in the case of cardiovascular disease, the layman's language suggests an intuitive recognition of the psychological factors in gastrointestinal disease which exceeds that of the average physician. Many terms indicate a very definite relation between personality traits and various parts of the gastrointestinal tract. We speak of a "sucker" as the man who "bites" and is fooled. We designate certain persons as "leeches" because of their hanging-on propensity. We speak of a person "sinking his teeth" into a job; we speak of not being able to "stomach" something, of "guts," of "intestinal fortitude," of "having a belly full," and of "biting off more than one can chew." A large number of vulgar words and phrases for feces are used colloquially to indicate depreciation or disparagement or hate.

There is a third large group of illnesses in which the psychological component is becoming more clearly recognized—those individuals with various types of aches and pains in the head, the joints, the muscles, and elsewhere. The whole group of cephalalgias, arthralgias, and myalgias are becoming increasingly recognized as having a very major psychological component.

While allergies are less definitely psychogenic, there is much evidence that, in certain instances, emotional factors are of major importance, at least in the production of the trigger mechanism of the allergic response. The role of emotional factors in these and, in fact, all the conditions mentioned probably represents the most promising area of research, with perhaps the largest pay-off in results, of any group of problems in medicine. A major step forward will be the joint approach of the internist and psychiatrist. It is hoped that we in the Army can more firmly build the framework of close teamwork and cooperation between these two specialties which will carry over into civilian life.

MECHANISM

Quite apart from the research possibilities, in the Army we are faced with the facts that a large number of these psychogenic somatic disturbances are present in all our medical wards and in many, if not most, instances our medical officers are not sufficiently oriented and trained in this phase of medicine to provide the most effective treatment. Consequently, if it is our aim to diagnose and treat these cases of "organ neuroses" on medical wards, we must make two major educational efforts. First, the average physician must become aware of the prevalent mistaken attitudes and practices now used, such as making a diagnosis by exclusion, by examining a man carefully physically and chemically, but ignoring the psychological

examination, and because of lack of training not knowing how to prepare a patient to understand the concept of functional illness. Finally and probably more important, a too-prevalent attitude that the organic type of problem is the most interesting. Undoubtedly, the latter is due to our medical training which emphasized the organic and often failed to appreciate the reality and importance of illnesses caused by emotional maladjustment.

Our second educational effort must provide the average medical officer with the rationale for the understanding and treatment of this type of problem. This implies that the physician must become acquainted with psychological medicine and with the dynamics of personality adjustment. Fundamental in this understanding is the machinery by which and through which the personality operates. He must have some grasp of what is meant by and what happens in the unconscious as well as the conscious portion of the personality. As the organs function unconsciously to the individual, so a considerable portion of the personality, the psychic life, functions unconsciously to him. Our assumption is that even a major portion of the personality is unconscious and that this unconsciousness is a dynamic and potent force in personality function. It is not difficult for the average individual to grasp the fact that blushing is a physiologic change entirely due to emotion. Paradoxically, many physicians are entirely ignorant of the mechanism by which chronic emotional tension at an unconscious level may produce major physiologic changes and, in fact, largely account for the many symptomatic expressions of the "organ neuroses" as well as other types of psychoneurosis.

Basic in this education is the role of anxiety, that phenomenon comparable to pain, which is a central dynamic theme in all psychiatry. All of the conditions for which the psychiatrist is consulted can be regarded as manifestations of anxiety. We must differentiate anxiety from fear, the former being an internal threat and the latter a response to external threat. Often they are associated, but the devious directions by which anxiety may express itself are far more complicated than expressions of fear. Sometimes anxiety is expressed as a direct injury to the personality and is manifested as a depression with the usual concomitant physical symptoms. Sometimes it is expressed in combination with aggressive behavior against the external situation as in criminal behavior, sometimes indirectly as in alcoholism, sometimes on the person himself in a self-inflicted injury. By automatic mental machinery, it may be converted into various types of psychological symptoms— the compulsion obsession or paranoid trends. Very often it is turned on the self and sometimes reflected in ideation as hypochondriasis, sometimes directly through the central nervous system as conversion hysteria— the paralysis and anesthesia— and very often through the autonomic nervous system in the

group of illnesses called the "organ neuroses," the psychosomatic expressions.

Finally, this educational endeavor must attempt to give the physician some rationale as to the nature of these specific organ symptoms through which the patient expresses his maladjustment. This is most difficult, for we cannot as yet completely explain the choice of the neurosis. Why does one person use predominantly his cardiovascular system to express emotional response and another person his gastrointestinal for similar needs? In all cases the individual's choice is automatic and unconscious and there is little doubt that, in all cases, the choice is predicated on the particular personality construction.

We have begun to accumulate data on these personality structures which give insight into the meaning of particular symptoms. The gastrointestinal system is particularly adapted to expressing the individual's major functions of taking in or receiving, or holding on to or retaining, and finally of eliminating or giving. One of the simple, now fairly well-accepted, illustrations is the patient who has a strong unconscious need for affection, a strong desire to be appreciated and taken care of, who physiologically translates these trends as a need to be fed or for food. In a sense the gastrointestinal tract, and particularly the stomach, tries to serve a double function—that of an emotional recipient as well as a food recipient with the concomitant necessity to serve as the organ of digestion. This illustration serves only to indicate the trend of our findings and can be greatly expanded. Increasing data are available regarding the personality characteristics in various of the so-called organ neuroses. Also the psychological factors in many organic conditions have become recognized, particularly those which may represent the prolonged effect of emotional tensions.

My point in this discussion is to indicate the necessity of giving the physician some rationale for understanding the manifestation that he sees, some basis on which he can understand the irrationality of treatment by platitudes and placebos, and, most important, that these illnesses are just as real and valid as a verrucous growth on a heart valve or the multiplication of a particular bacillus in the urinary tract.

In the Army we have a unique opportunity and responsibility. We have a peculiar social organization of medicine which permits those in supervisory positions to place great emphasis on policies and practice. After a fashion, we control and regulate these policies and practices for the largest single group of doctors in the world. If we believe that the principles presented here are valid, that they are vitally important, that, if placed into actual practice, they can be of tremendous benefit to all medicine, then this audience has more power to accomplish these progressive changes than any other medical group in history.

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Tropical Psychiatry

CAPTAIN PAUL D. MACLEAN
Medical Corps, Army of the United States
MAJOR MERRILL MOORE
Medical Corps, Army of the United States
and
CAPTAIN DAVID CROCKER
Medical Corps, Army of the United States

In the struggle against the Japanese in the South Pacific the large number of psychiatric casualties presented a major problem. The conditions under which our men were fighting in the tropical islands were different from anything American troops had faced in previous wars. The soldier had to stalk a savage, cunning, and unseen enemy through dense jungle thicket. It was not the open and group kind of warfare to which he had been conditioned. Over and above the fear of death, there were other factors of psychological significance. The soldier was a vast distance from home. Coming out of temperate America, he was poorly conditioned to the tropical heat and rains and the monotony of the jungle scene. His food was usually unappetizing. At night, crawling wild life and the weird cries of tropical birds were often indistinguishable from the enemy. He was plagued with malaria, and outbreaks of diarrhea and dysentery were frequent.

It is agreed that every man has his breaking point. Of interest to the medical officer was whether or not the deprivations, disease, and type of fighting met with in the tropics greatly reduce the threshold at which neurotic symptoms could develop and so account for the high number of psychiatric casualties. Or was the problem largely one of inadequacy on the part of the soldier? There had been no systematic psychiatric screening of these troops prior to induction, and the nervous make-up of the average soldier was unknown. As a preliminary step in the study of the relative bearing of the basic personality, the so-called toxic-exhaustive state, and the morale factors on the development of the psychoneurosis seen in the tropics, we decided to review certain nervous factors in the histories of successful and of psychoneurotic soldiers. This paper reports the incidence of nervous factors in the family and past history of a thousand successful soldiers and of a hundred psychoneurotic soldiers who had seen military duty in the tropics.

The assistance of Sgt. J. Krasowsky, Sgt. J. Ullrich, Sgt. E. Schum, and Pvt. P. Martin is gratefully acknowledged.

The term "successful" was used in relation to the first group because these men belonged to a division which had campaigned successfully against the enemy and were now in a rest area after several months in the tropics; 99.7 percent of these men had been through one campaign, 69 percent through two campaigns, and 16.2 percent through three campaigns; 94 percent had been in actual combat; 8.5 percent had been wounded in combat. All had been subjected to numerous air raids. In addition to the vicissitudes of combat 88.9 percent had suffered one or more attacks of malaria, and 57.8 percent, three or more attacks; 61.8 percent had one or more bouts of diarrhea, and 30.8 percent had dysentery; 23.1 percent suffered from some other illness such as hookworm, infectious jaundice, etc.; 65.5 percent had lost 10 pounds or more in weight;* 88.3 percent had been overseas eighteen months or more.

The data on the successful soldiers were obtained during a hospital admission. Most of these men were admitted for malaria; the remainder, for some nonpsychiatric complaint. All were enlisted men. They were interviewed by enlisted personnel who had been instructed in this work. The interview was obtained on a confidential basis. They gave the information with the understanding that they were helping the doctors collect some figures and that the information would be in no way "used for or against" them. The data on the psychoneuroses were obtained from 100 unselected records of soldiers who, because of their psychiatric illness, had been transferred to the continental limits of the United States. They had been carefully studied from the psychiatric and medical point of view. They had soldiered under conditions similar to those of the successful group. Some had broken down prior to combat; others, following combat.

An inquiry was made into the nervous factors of the individual's family and past history. The questions were phrased so that they could be answered "yes" or "no." A brief statement may be made in regard to the terminology used. "Nervousness" is generally understood to be a state of undue excitability. A "nervous breakdown" may be considered as such a state of "nervousness" as to preclude a person's carrying on his ordinary activities and perhaps to necessitate his going to bed, but not necessarily requiring institutional care. An inquiry was made into the neurotic traits and phobias of childhood, because it was felt such information would give the general incidence of nervous tension as well as conflicts and fears arising out of the child's relation to his family and his environ-

*It is outside the scope of this paper to present comparative data on the incidence of illness and exhaustive factors among successful and psychoneurotic soldiers. Nevertheless, it may be of interest to give here the incidence of previous infection and weight loss among a hundred psychoneurotic soldiers. Thirty-three percent had malaria one or more times; 8 had three or more attacks. Eight had one or more bouts of diarrhea; 32 had had dysentery; 12 had suffered from other illnesses; 68 had lost 10 or more pounds in weight.

ment. Our study did not attempt to elicit information of a more complex nature since this would not have been practicable on such a large scale. The results of the study, shown in table I, indicate that there was not a striking difference in the nervous heritage and nervous background of childhood between the group of psychoneurotic and successful soldiers. The greater incidence of neurotic traits and phobias among the neurotic group was evidence that these individuals were more subject to emotional instability, conflicts, and fears during childhood than were the successful soldiers.

TABLE I

	Successful		*Psychoneurotic*	
Family history				
"Nervousness" in immediate family	38.6		44.0	
Mother		25.5		27.0
Father		8.5		15.0
Siblings		11.4		6.0
"Nervous breakdowns" in immediate and related family	26.5		25.0	
Mother		15.7		11.0
Father		3.8		7.0
Siblings		6.1		4.0
Relatives		3.0		3.0
Insanity in immediate family	2.5		5.0	
Insanity in related family	3.4		3.0	
Epilepsy	4.0			
Alcoholic father	7.1		14.0	
Past history				
"Nervousness" as child	25.4		17.0	
"Nervous breakdown"	4.3		4.0	
Consultation with psychiatrist	3.0			
Fits or convulsions	2.8			
Fainting, one or more attacks	30.1			
Neurotic traits of childhood				
Remembered thumb-sucking	11.4		13.0	
Remembered bed-wetting at 6 years or after	33.2	17.1	37.0	
Fussy over food	31.8		44.0	
Nail biting	36.2		48.0	
Temper tantrums	19.1*		35.0	
Stuttering	15.6		16.0	
Talked in sleep	36.5		} 56.0	
Walked in sleep	13.7		}	
Phobias of childhood				
Night	26.6		} 59.0	
Dark	34.7		}	
Loud noises	14.1		39.0	
Thunder and lightning	29.3		43.0	
Crowds	11.0			
Closed places	11.2			

All figures in percentage.
*45.6 admitted to easy loss of temper.

Eye and Ear Sequelae of Scrub Typhus Fever

MAJOR LAWRENCE R. DAME
Medical Corps, Army of the United States

With military operations in the South Pacific islands many cases of tsutsugamushi fever have developed. Because many of the patients gave a history of ocular and aural symptoms during the acute phases of the disease, it was considered important to determine their persistency and to record the symptomatology and clinical findings of the special organs of the eye and ear in 50 convalescent cases seen at a general hospital. The following procedures were carried out in each case: review of the record to establish that the patient had scrub typhus fever less than four months previously; review of the history for previous eye and ear diseases; review of the ocular and aural history of the onset, the fastigium, and the convalescent period of the illness; objective examination, visions, visual fields (3/330 white—9 candle power), blind spots (6/2,000 white—2.5 candle power), extraocular movements, static refractions with full homatropine cycloplegia, biomicroscopic examination of the media, and studies of the fundi; examination of the ears, evaluation of the hearing ability by the use of the whispered voice, conversational voice, and of tuning forks 512, 1,024, and 2,048 vibrations); and caloric examinations.

Past history. The ocular history prior to the development of scrub typhus was normal in 38 cases. Minor ailments such as "styes," brief wearing of glasses, and otherwise unimportant abnormalities were reported in 12 cases. The past history disclosed only 4 cases with previous aural disease. One had a simple mastoidectomy at the age of 6 years without subsequent symptoms; when examined here he had a healed mobile drum. Three other patients had otitis media, one of whom had had recurrent attacks until 1938, and another of whom had required eustachian tube treatments as recently as nine months prior to the onset of scrub typhus.

TABLE I

Eye symptoms in scrub typhus

Symptoms	Onset (1st week)	Fastigium	Convalescence	When examined
None	22	22	26	—
Blurring	11	9	8	1
Pain	11	10	7	0
Redness	6	8	4	0
Lacrimation	5	4	2	2
Tiring	3	3	8	1
Burning	8	7	3	2
Photophobia	1	3	1	0

Ocular symptoms in acute phase. About one-half the patients in this group did not remember having had any eye symptoms (table I). All but 4 of the remaining group had lost their symptoms by the time of this study. Even in these the symptoms, blurring of vision, "redness" of the eyes, and burning, were steadily subsiding. Thirty-five patients had normal visual acuity, and 5 others were improved to 20/20 by glasses. Eight had corrected visual acuities of 20/30 or 20/40. Two other visual acuities of 20/50 had been "unchanged by the illness" (table II).

TABLE II
Visual acuity

20/20	70 eyes
20/20 with glasses	11 eyes
20/40 and 20/30 with glasses	17 eyes
Others	2 eyes

Ocular findings in convalescent phase. In only one case was recent evidence of external disease found. This was a 1-mm., well-healed, asymptomatic, nonspecific opacity. The optic discs had a nonspecific hyperemia, and no retinal changes were noted. The visual field-and-blind-spot examinations of the retinal activity showed that with only 2 eyes were the perimetric fields and the blind spots normal. With 40 other eyes having normal perimetric fields the blind spots were moderately enlarged, ranging up to 35 by 40 cm. The remaining 51 perimetrically normal fields were accompanied by markedly enlarged blind spots ranging up to 38 by 60 cm. The average size of all blind spots was 31 by 40 cm. There was contraction of the visual fields in seven eyes, the greatest loss being 20, and the average loss 15, degrees. Ten eyes had a scotoma varying in size from 11 by 15 cm. to an irregular one-half quadrant.

TABLE III
Aural symptoms in scrub typhus

Symptoms	Onset (1st week)	Fastigium	Convalescence	When examined
None	24	11	27	—
Hearing, poor	7	5	8	2
Hearing, extremely poor	8	19	7	0
Tinnitus	10	15	14	0
Pain in ears	3	3	0	0
Vertigo	0	3	0	0
Events of acute phase not remembered	1	8		

TABLE IV
Reduced hearing acuity findings

	Right ear	Left ear
Whisper	4	2
Conversation	0	0
Rinne 512 d.v.	3	1
Weber	2	3
1,024 d.v.	2	0
2,048 d.v.	4	2

Aural symptoms in acute phase. Symptoms referable to the ear are classified (table III) according to the period of occurrence during the illness. Eight patients had no memory of the acute phase; so it is impossible to say whether they had ear symptoms. The remaining 42 patients noted diminished hearing (31 cases), tinnitus (28 cases), pain in the ears (3 cases), and vertigo (3 cases). During the first week one-half, and during the fastigium

78 percent, of the patients had aural symptoms. At the time of this examination only two patients still had aural complaints—slight deafness to faint sounds in each case.

Aural findings. The ears were normal objectively in 46 patients. The abnormal ear findings were limited to three pairs of mildly retracted but mobile drums and one pair of drums with old, small plaques. There was no evidence of recent acute infection of the tympanum. Thirty-nine patients had normal hearing. The remaining 11 showed reduced hearing (table IV) brought to light by one or more of the methods enumerated, but none showed reduced hearing to conversational tones. There was no consistent range of loss of auditory acuity.

A total of 59 out of the 100 ears (23 pairs and 13 singles) showed diminished response to caloric stimulation. Vestibular testing was carried out only with water at 68° F. The customary arbitrary limits of a caloric stimulation period of thirty to 60 seconds were used. Recording was made of associated pallor, nausea, vomiting, perspiration, past pointing, falling, and subjective sensations of rotation, but all estimations of function were made on the objective findings of the nystagmus produced. Fourteen patients showed normal response to caloric stimulation with both ears. Thirteen showed normal response with one ear and diminished response with the other; of these, with additional stimulation 8 had satisfactory, and 5 still had diminished, response. The remaining 23 patients had bilaterally diminished responses, 18 of these not obtaining satisfactory responses with additional stimulation. The depression of responses involved all of the semicircular canals. Of this group, over 120 seconds of caloric stimulation were required bilaterally by 8 patients and unilaterally by 2 others in order to initiate ocular response.

DISCUSSION

The mode of production of diminished function of the optic and vestibular symptoms is not definitely determined. The marked and prolonged prostration of the patient should be remembered. The factors of previous or concurrent disease or of nutritional defects were carefully eliminated in the patients examined. The ocular symptoms were temporary and of minor importance. The hearing faults were also minor, and those found could not be attributed to this disease. The chronicity of the diminished vestibular responses to caloric stimulation could not be determined as the patients were returned to full or limited duty or transferred to other hospitals. The implications of these findings from the standpoint of aviation medicine are obvious. The importance of careful follow-up studies of all flying personnel who have had tsutsugamushi fever must be emphasized, especially of pilots.

SUMMARY

Among 50 patients seen at a general hospital, convalescent (four to sixteen weeks, average six weeks) from scrub typhus fever, 50 percent of them had noticeable eye symptoms during the various stages of the disease, which proved to be transient and of minor importance. No permanent loss of visual acuity was found to be associated with this disease. In 98 percent of these eyes there were some abnormal subjective retinal findings, consisting of enlargement of the blind spots, contraction of the visual fields, and scotomata. The average size of all of the blind spots was 30 by 40 cm., and the largest 38 by 60 cm. There were 7 percent of field contractions, and 10 percent had scotomata, the largest being one-eighth of the visual field.

Minor nonspecific involvement of the cochlear system was found in only 11 percent of the ears at this stage of convalescence, although by history 78 percent of the ears had had hearing loss or tinnitus. All 50 patients had normal hearing with conversational tones. Involvement of the vestibular system was indicated in 59 percent of the ears with caloric stimulation. The mode of production and chronicity are not definitely known.

Management of Peripheral Nerve Injuries

The program evolved for the management of peripheral nerve injuries in the European Theater of Operations was, like all similar programs, based on fundamental surgical principles modified, as circumstances required, to bring them into accord with the exigencies of the military situation. These principles were as follows: (1) In view of the irreparable degenerative changes which occur, with the passage of time, in the distal segment and the end plates of severed nerves, early surgical repair is essential for the best results. (2) Immediate primary suture of a severed nerve is desirable theoretically but in practice is not a good plan, if only because battle injuries are almost invariably associated with contusion of nerve tissue. (3) Experimental and histopathologic evidence indicates that the optimum time for end-to-end suture of a severed nerve is between the third and ninth week after injury, and that repair between the twenty-first and the twenty-eighth day is probably productive of the best end results and can be carried out with the least technical difficulties. At this time mobilization of the proximal and distal nerve segments can readily be accomplished, fibrosis in the wound and particularly in the nerve stumps is minimal, and flexion of contiguous joints can usually be readily achieved.

Condensation of an article by Colonel R. Glen Spurling, M.C., A. U. S.

While neurosurgical casualties had priority in air evacuation from the Continent to neurosurgical centers in the United Kingdom, peripheral nerve injuries had the lowest priority in this category, with the result that such patients seldom reached these centers until two to three weeks after being wounded. By this time the injuries had been débrided and delayed wound closure had usually been done.

When evacuation facilities permitted and other circumstances were favorable, the patients were transferred to the zone of the interior for definitive surgery. When facilities were not available, they were operated on in the United Kingdom and were transferred to the United States as soon afterward as possible; from the surgical standpoint, transportation within the week was practical in most uncomplicated cases.

The following plan of management was carried out: (1) Injury to one or more of the major nerve trunks was regarded as a possibility in every wound of the extremities. Simple tests for motor and sensory function were employed to identify the involved nerve or nerves. (2) The usual regimen of management of soft-tissue wounds (débridement and delayed wound closure) was strictly adhered to. (3) If the severed nerve ends were visualized when débridement was done, they were approximated with tantalum wire or fine stainless steel wire, or were anchored in surrounding soft tissue, to prevent retraction. The suture material was selected with the idea of its usefulness in later roentgenologic demonstration of the site of the injury and the extent of the defect. Elaborate primary nerve suture was never attempted. (4) The muscles or facia were approximated loosely over the exposed nerve trunk, but a pack was never used. (5) The extremity, whether or not bone injury was associated, was immobilized in the most favorable position to prevent deformity, casts and elaborate splinting seldom being employed. (6) Careful notes were made as to the condition of the injured nerves and the precise nature of the initial surgical procedure.

The following technical considerations were impressed on all surgeons associated with the peripheral nerve injury program: (1) that the nerve ends must be accurately trimmed until essentially normal tubules were visible; (2) that the divided nerve ends must be approximated with the greatest care by interrupted epineural sutures; (3) that the suture line must be absolutely free from tension; (4) that hemostasis must be rigid.

The use of a sling stitch (through-and-through suture) was optional. Silk was used occasionally, particularly at the beginning of the program, but wire was generally preferred, for the roentgenologic reason mentioned as well as because it is practically inert in human tissue. A small cuff about the

suture line was used in most cases, and except in a few instances, when a plasma clot was used according to the technique of Tarlov, was of rolled tatalum foil.

Extension of the flexed joint was begun at the end of the second week after operation and was completed by the end of the fifth week, the plan being considered safe because of the comparative freedom from extensive fibrosis observed in patients treated by early neurosurgery. On the other hand, a 4 percent incidence of wound disruption observed in a group of followed-up cases prevents definite statements as to the wisdom of this policy until other factors entering into the picture are clarified.

Physical therapy, both before and after operation, was an integral part of the program. It included the usual routine measures, as well as daily galvanic stimulation, beginning with fifteen brisk contractions daily and progressing gradually to thirty contractions. Windows were cut in casts used for postoperative immobilization and galvanic stimulation was begun the day after operation.

Of 6,245 battle casualties hospitalized with major nerve injuries between D-day and VE-day, about 46 percent were operated on overseas. In almost 47 percent of the surgical cases, the nerve was found intact and neurolysis, usually external but occasionally internal, was done. In the remaining cases the operation consisted of end-to-end suture. The practice of early neurosurgery reduced the number of insurmountable gaps to less than 1 percent, as compared with 10 percent in the North African Campaign.

The time lapse between wounding and neurorrhaphy varied from an average of 28 days in the period immediately after D-day to an average of 42 days in the period of heavy fighting before VE-day. The average of 39 days for the whole period is longer than the optimum interval (21 to 28 days) but is probably the shortest practical period within which definitive neurosurgery can be done on large groups of casualties under conditions of active warfare. Primary healing of the wound occurred in more than 98 percent of all cases, and there was only one fatality in the whole series, this following local nerve block and presumably being caused by a novocain reaction.

At the beginning of the program, early nerve surgery was carried out only in cases in which bone complications were not present. Later, combined injuries were brought under the same program, with very satisfactory results.

A peripheral nerve registry has been established in the Surgical Consultants Division of The Surgeon General's Office, with the purpose of following up, analyzing, and assessing the results of the program for the management of peripheral nerve injuries. The data, which will shortly be published, fully confirm the soundness of the program.

Management of Suprapubic Cystostomy

CAPTAIN JAMES H. SEMANS
Medical Corps, Army of the United States

A steadily increasing number of patients with suprapubic cystostomy are being evacuated to the zone of the interior, and a high percentage of them have complications localized in the urinary bladder. Among 45 cases received at the McGuire General Hospital, 11 had urinary calculi, 1 mm. to 1 cm. in diameter, 12 had encrusted cystitis, and 11 had mucopurulent exudate.

IRRIGATIONS

Irrigation of the bladder through the suprapubic catheter is frequently effective only in maintaining the patency of the catheter. It was observed in the cases mentioned above that the exudate and small calculi remained in the most dependent portion of the bladder, over the urinary trigone. It was also noticed that irrigations were much more effective if carried out with the patient rolled *completely* onto his abdomen. The suprapubic area then became the most dependent portion of the bladder and all the nonadherent exudate was removed. In cases of spastic paraplegia with flexion of the thighs, the prone position is impractical. The calculi and encrusted particles can be removed instrumentally through the suprapubic sinus tract. This route eliminates the trauma of transurethral instrumentation.

APPARATUS FOR IRRIGATION OF URINARY BLADDER

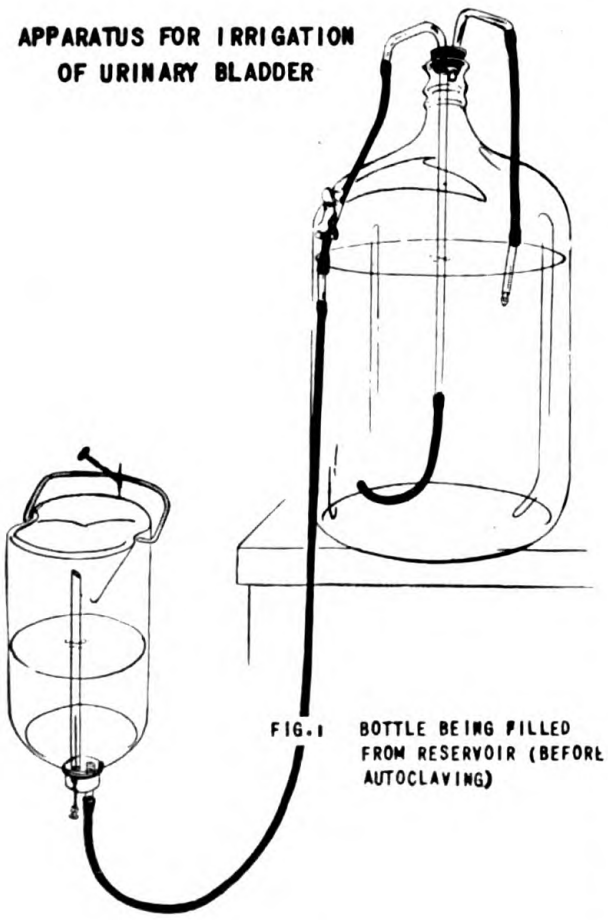


FIG. 1 BOTTLE BEING FILLED FROM RESERVOIR (BEFORE AUTOCLAVING)

The suprapubic catheter can be irrigated by the patient himself. A closed system is assembled by using the standard field set for intravenous fluids. Figure 1 shows the used container being filled with irrigating solution by siphonage. After autoclaving, the set serves as a reservoir. Figure 2 illustrates the apparatus in use. To show the Y-tube adapter, the patient is not rolled completely onto his abdomen. Either the Y-tube (Med. Dept. Item No. 4002000) or a 15-gage intravenous needle (Item No. 3357800) can be used to connect the reservoir to the drainage system. It is essential to have an easily compressible clamp (Item No. 4180000). By kinking the outlet tubing and releasing the Mohr clamp, the patient fills his own bladder. By releasing the clamp and the kink in the tubing, the irrigation is completed. This has proved to be a practical means for the patient to measure and maintain a proper bladder capacity. On the reservoir bottle are markings of volume.

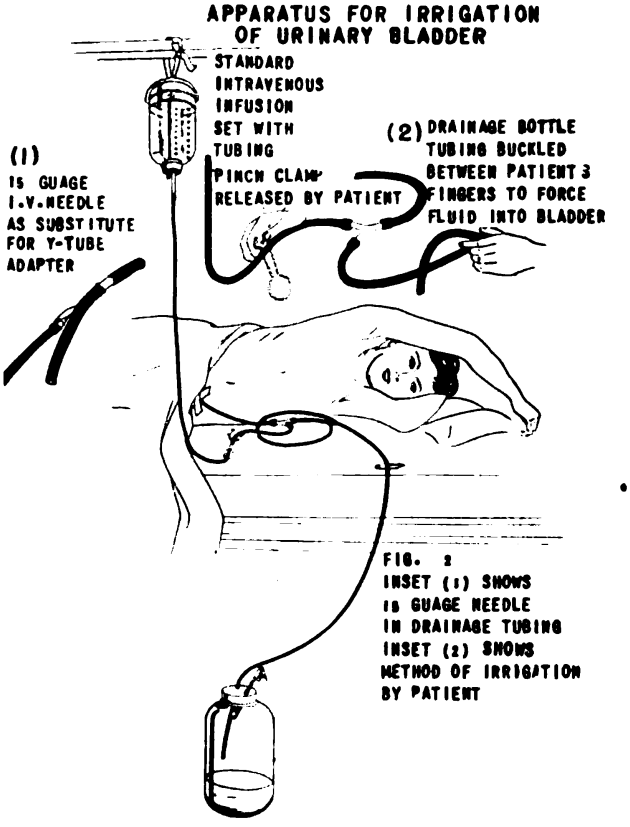


FIG. 2
INSET (1) SHOWS
18 GUAGE NEEDLE
IN DRAINAGE TUBING
INSET (2) SHOWS
METHOD OF IRRIGATION
BY PATIENT

TESTING BLADDER FUNCTION

The vesical function can be determined, if the catheter fits snugly in the suprapubic sinus tract. The bladder is slowly distended with fluid until the patient voids or feels discomfort. Not more than 200 cc. are used. If micturition occurs through the urethra, an effort is made to empty the bladder by pressure over the lower abdomen. Then, the suprapubic catheter is opened and the residual urine measured. In this way it is possible to predict the efficiency of voiding after closure of the cystostomy. If the residual urine is less than 100 cc., the suprapubic catheter is no longer necessary. A urethral catheter is inserted and left until the suprapubic wound has been dry for six consecutive days, and is then removed. If the residual urine contains sediment, after removal of the urethral catheter, it may be necessary to irrigate the bladder at intervals.

ADVANTAGES OF SUPRAPUBIC CYSTOSTOMY

This method of drainage offers advantages for the patient who must be transported over great distances without specialized care. If the cystostomy is established early, an incidence of epididymitis as high as 22 percent (in a series of 45 cases with urethral drainage) can be avoided. Urethritis, penoscrotal abscess, and subsequent fistula represent additional complications to prolonged urethral drainage. The opportunity of testing bladder function, before removing the catheter, has been mentioned. When necessary, instrumentation can be carried out through the suprapubic sinus tract. Calculi and encrustation have been frequently extracted in this way. Two disadvantages of this type of drainage can be circumvented. With the closed system of self-irrigation, the patient can maintain a proper vesical volume. Dependent drainage can be obtained by irrigating the bladder in the prone position.

Early Treatment of Extremity Wounds

LIEUT. COLONEL HAROLD A. SOFIELD[1]
Medical Corps, Army of the United States

The South Pacific Area was the first region in which large numbers of United States Army troops were employed offensively in this war. Since combat has now been reduced in this theater, it is timely to review the principles of surgical treatment which have been established for battle conditions in tropical regions. While certain rules are applicable all over the world, other surgical doctrines are made applicable to the conditions imposed by local conditions of combat, terrain, climate, and mobility of forces. The criteria set forth in this article cannot always be met; but, in the vast majority of instances, surgeons in forward zones can by hard work and ingenuity establish very satisfactory conditions for work.

Almost 75 percent of all combat injuries are extremity wounds, the treatment of which should be thoroughly understood. The following principles for early treatment of such wounds have been established here by directives, lectures, discussions, and actual field work in the combat zone. Studies of the results of these procedures have been made and modifications advised when found desirable. No inflexible set of rules can be recommended; changes must be made as experience dictates. Formerly, the local use of sulfanilamide was recommended; now that investigation has thrown doubt on the local application of the drug, it is no longer advised. The use of sulfanilamide orally or parenterally should never be omitted, except in rare instances where its use is contraindicated or when penicillin is being used

1. Consultant in orthopedic surgery, South Pacific Area.

alone. Emphasis must be placed on the realization that these recommendations are for treatment of extremity wounds in tropical *combat zones*; treatment in rear areas may differ in some details.

GENERAL RECOMMENDATIONS

The state of shock so frequently accompanying extensive extremity wounds demands immediate treatment, and an integral part of the early treatment is reduction of gross anatomical deformities due to fracture. Do not treat just the manifestations of shock; treat the causes.

Débridement should be done at the earliest possible time; however, no definite rule can be established. We advise that all dirty wounds be cleaned, foreign material removed, dead tissue excised, and adequate drainage established regardless of the time that the wound is first seen, provided the patient's condition permits surgery. It would be foolhardy to do more than establish adequate drainage in a patient exhibiting a septic temperature.

Shell fragments, bits of clothing, wood, coral, and pieces of other foreign material should be removed from the wound area during débridement. The only exception is in the case of shell fragments or bullets which are not easily accessible, the removal of which would open new tracts into the fracture region. Such fragments are better left in place for removal later, if necessary.

SPECIFIC RECOMMENDATIONS

The operating space should be screened with either wire or cloth netting. Adequate lighting must be provided so that good visualization of the work can be obtained. Have anterior-posterior and lateral x-rays made of all fractures and soft-tissue wounds. When wounds are in the upper thigh, make x-ray examination of the entire abdomen. The patient must be anesthetized so that the wound can be thoroughly explored and débrided. General treatment with transfusions should be instituted during débridement, if indicated. All débridements must be done with strict aseptic technique, using sterile drapes, sterile gowns, caps, masks, and rubber gloves.

SURGICAL TECHNIQUE

The area surrounding the wound should be washed thoroughly with soap and water, the wound area itself being blocked off with sterile dressings. If the wound is very dirty, the area should be flushed with sterile saline with the flow directed from the depths to the surface by means of tubing.

Proceed on a definite plan with each débridement; i.e., after stopping gross bleeding, work from the outer edges down to the depths, first on one side of the wound, then on the other. Do not haphazardly peck at wounds. Only a narrow rim of skin need be removed in ordinary cases. Conserve as much viable skin as possible; cut skin with scalpel, not with scissors. Excise all

subcutaneous tissues of questionable vitality. In excising muscle tissue, be guided by the color, contractability, and bleeding of the tissue as well as by the known blood supply to certain muscles. Any tissues grossly contaminated with foreign material should be removed, i.e., viable muscle tissue into which dirt or coral has been ground so that it cannot be removed. If visualization of wounds is inadequate, extend wounds with longitudinal, not transverse, incisions. After thorough débridement, flush the wound with saline with the flow directed from the depths to the surface by tubing.

Do *not* close wounds following débridement. Wounds of the face are the only exception to this rule.

Blood vessels. Carefully tie off any large bleeding vessels, but do not attempt to stop all oozing by means of ties. The less foreign material left in the wound the better. Ligate and divide injured vessels; do not ligate in continuity.

Nerves. Do not sacrifice any nerve tissue unless absolutely necessary. Try to suture large nerve trunks and immobilize the part so that nerves are not under tension. If impossible of apposition, suture nerve ends to nearby tissue with stainless wire for future identification.

Bone. Do not remove all loose pieces of bone. Only remove small fragments that have been widely separated from their anatomical sites and are without periosteal attachment, and pieces of bone that have been grossly contaminated. Do *not* use any form of internal fixation, such as screws, pins, plates, or wires, in the débrided area. Keep foreign material to a minimum.

Shell fragments. Remove all shell fragments and bullets that are easily accessible but do not open large tracts into the wound area by exploring for remote missiles.

Joints. All foreign bodies should be removed from joints, including any small pieces of loose bone. Small wounds of joints into which no ascertainable foreign material has been introduced and the tissue damage minor in amount may be treated by external cleansing and splinting, but they should be kept under close observation and the joint opened if pain, swelling, or elevation of temperature develop. Penicillin may be injected into the joint. Large wounds of joints require exploration of the joint, washing with sterile saline, débridement, introduction of penicillin, if available, into the joint, and closure of the capsule if possible. After débridement, do *not* put drains into joints; drain down to the capsule only.

Perforating wounds. It is not advisable to use "pull-throughs" of gauze for attempted cleansing of perforating wounds. It is unwise to neglect examination of perforating wounds that have penetrated deep tissues, even though they appear minor at the surface ends. Exploration through longitudinal incisions often reveals extensive soft-tissue damage that requires débridement. Superficial perforating wounds that are

to be kept under observation by the admitting hospital, and in which no evidence of deeper damage is apparent, may be treated by skin-edge excision and flushing with saline. When in doubt, explore the wound.

Sulfonamides. Local application of sulfanilamide is no longer advised; but if used, the technique is as follows: Sprinkle sulfanilamide into the wound or use insufflator. Be sure the sulfanilamide reaches all crevices of the wound and is distributed evenly. Use blunt instrument or gloved finger to assure complete distribution of the drug and do not pour the powder into the wound. Caked sulfanilamide may act as a foreign body. Sulfadiazine, administered orally or parenterally, should be given in adequate amounts following débridement.

Drains. Do not hesitate to make counterlongitudinal incisions to provide adequate drainage for large wounds, particularly of the thigh. Do *not* use through-and-through drains and do *not* use stiff rubber tubing for drains. Do *not* use dry gauze for drains following débridement.

Petrolatum gauze. Place petrolatum gauze around the wound edges to protect skin from wound excretions. Put petrolatum gauze drain into the wound but do not pack it in. The most common fault of wound dressing in this theater has been in the packing of gauze drains. Such drains often act as plugs and dam the opening, causing pain, elevation of temperature, and necessitate removal of the dressings.

Dressings. Apply copious fluffed dressings over wound area held in place by snug sheet wadding. *Never* use circular gauze or muslin bandaging to hold dressing in place if plaster cast is to be applied.

Fixation of fractures. The initial treatment of compound fractures in the combat zone very seldom requires the use of any pins or wires, even remote from the wound. The large amount of soft-tissue damage, including nerves, and the marked comminution of fragments usually permit the accomplishment of good length and alignment without resort to fixation apparatus. A well-fitted plaster cast usually maintains satisfactory position and provides adequate immobilization in compound fractures resulting from battle wounds. If pin fixation is desirable, it is better to institute the procedure in one of the rear hospitals where more definitive treatment and longer time for observation are available.

Amputations. If débridement is supplemented by necessary amputation, only the guillotine type is permissible, performed at the lowest possible level. Note that the guillotine-type amputation does not mean cutting all tissues at the same level. The skin is cut at the lowest level, then after retraction of that tissue, the muscle is cut at a higher level, and finally, after muscle retraction, the bone is cut at the highest level. Do not close amputation sites.

Apply skin traction to amputations either at finish of sur-

gery or within a few days. This is best applied by gluing snug stockinet to the extremity with Ace Adherent or compound tincture of benzoin, fastening loose end of stockinet to splint with elastic traction.

Soft-tissue wounds. Large soft-tissue wounds require casting after débridement, the same as do compound fractures. Proper immobilization tends to limit the spread of infection, promotes healing, and provides comfort.

Plaster casts. Do *not* use unpadded plaster casts following débridement; always use sheet wadding. An inadequate plaster cast is not only useless but dangerous. Make casts longer than necessary rather than as short as possible, make them substantial, and make every effort to see that they dry promptly. In these tropical regions, where casts dry poorly, reinforcement with wire ladder splints incorporated into the casts is permissible, care being taken not to cause pressure points against the extremity. The Tobruk type of femoral splint-cast has not been as satisfactory in this theater as has the hip spica cast. The Tobruk splint-cast is not recommended for use in this area. In tropical climates and under combat conditions casts dry slowly, and advantage should be taken of heat cradles, which may be improvised, and of any available fans for circulation of air.

Mark every plaster cast with indelible pencil, showing extent of wound, general alignment of fragments, date of wounding and of débridement and casting, and estimated time when next change of cast will be necessary. If, after applying a plaster cast, there is any question of impairment of circulation, the cast should be completely bivalved and loosely fastened with bandage. Simple splitting of a cast does not provide enough freedom to relieve tension. Routine bivalving of all casts, though desirable, is not practicable in wet, tropical regions because of the delayed drying time of plaster, with resulting crumbling and breaking of bivalved casts and molded splints.

Hanging casts. Compound fractures of the humerus should be treated with shoulder spica plaster casts, not with hanging casts.

Splints. The Army leg splint is a lifesaving device, but its use in the combat zone should not be extended beyond twenty-four hours. When this splint is used with fixed instead of "floating" traction, it becomes uncomfortable and adds to the distress of the patient. A well-fitted hip spica cast is more satisfactory.

Do not evacuate patients in the Army leg splint if it is possible to apply a plaster cast before evacuation. The splint requires skilled attention to be efficient and is not comfortable with prolonged use. The hinged-ring splint should not be used for definitive treatment of fractures of the humerus. After débridement, a shoulder spica cast is preferable. Do not dress wounds after débridement and casting until absolutely necessary. Frequent dressings are to be discouraged.

Vol. IV
No. 5

Ear Molds for Hearing Aid Appliances

LIEUT. COLONEL G. A. MCCRACKEN
Dental Corps, United States Army

Many soldiers are being returned to duty wearing hearing aids. The technique for construction of the plastic ear mold used in conjunction with the receiver is presented here. This technique was worked out at the Deshon General Hospital acoustic clinic laboratory.

Impression. The ear should be cleansed of wax and examined carefully before starting. Impressions of the canal and outer ear are best taken with an elastic-type impression material of sufficient body to permit some compression of the canal walls. This is necessary to obtain a good seal which cuts down the incidence of feedback from the receiver. The impression is made with a methyl methacrylate material found very suitable for this purpose. A small amount of the impression liquid is placed in a glass cup or bowl and the powder added without spatulating until all liquid is taken up. Any excess powder is poured off. The material is then allowed to remain in the cup until it will register an accurate imprint without being "tacky"; it is then removed and kneaded in the hands of the operator until it is of sufficient puttylike consistency to allow working into the canal under pressure. It is best to lubricate the hands with liquid petrolatum, which prevents the material from sticking to the hands and forms a surface lubrication for the tissues of the ear.

Part of the impression mass is formed into a cone for initial insertion into the ear canal. No cotton plug within the ear has been found necessary when using this technique, except in cases where there is a large perforation of the drum present. After insertion of the cone into the canal, the material is kneaded and worked with the fingers until the canal is completely filled. Bulk material is then packed into the outer ear, completely filling it (figures 1, 2, and 3). Three to five minutes are necessary for setting time after which the cartilaginous tissues of the ear may be pulled back and the impression extracted intact (figure 4).

The impression should be cleansed with alcohol or soap and water, to remove any oil and wax adhering to the surface. Dip the canal tip once in melted beeswax for a distance of about one-third its length to provide an additional seal and compensate for polishing; this also facilitates the later removal of bulbous tips from the poured model.

Model. The impression should be poured immediately in a good quality dental artificial stone. When the stone has set,

heating will soften the wax coating and permit the removal of the impression material intact. Without waxing, bulbous canal tips frequently break on separating and are difficult to remove.

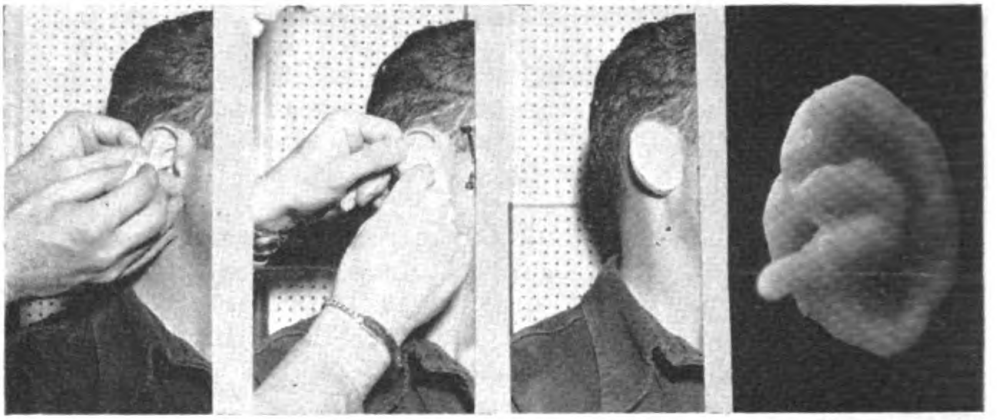


FIG. 1 FIG. 2 FIG. 3 FIG. 4

Waxing. Using the stone model, a mass of softened baseplate wax is forced into the concha area of the ear, completely filling it. An extension of the wax is placed under the helix, filling the fossa triangularis. This extension serves as a lock for retention of the finished mold. The surface of the wax is finished flat and flush with the high points of the tragus, antitragus, and antihelix so that when the receiver is attached to the finished mold it will not ride on any of these high points. A metal disk the size of a large Brush-type receiver, with a small hole punched in the center, or, a wheel, carborundum, No. 310, square edge, is just the right size and readily available for this purpose. The disk or stone is pushed down on the softened wax until it just contacts the high points mentioned. It is then centered where the receiver would ordinarily be, keeping the center as near the canal as possible. It is better to have the center lower toward the canal opening than above it in order to facilitate the later drilling of a hole through the canal itself. The center is then marked through the hole in disk or stone and becomes the location for a metal ring used to attach the receiver.

Placing the ring. The ring with spring removed is heated and placed in the wax, centering it over the previously marked spot. The metal rings have a groove cut in the inner surface to receive a small spring. This groove is closer to the surface on one side than the other. For most receivers the thin surface is placed uppermost to ensure a proper fit. Some receivers, however, fit better if the ring is reversed. This must be predetermined for the type of hearing aid receiver being used. The ring surface is made flush with the wax after which the wax in the center of the ring is scooped out flush with the bottom to permit holding when the case is flasked (figure 5).

Flasking. The waxed case on the stone ear model is half flasked in any vulcanite or ejector-type flask. All undercuts are removed. Soap solution or any suitable separating medium is applied and an old dental bur placed in the ring to serve as a strengthener. Stone is then poured over the ring and waxed surface area. Flasking is completed with plaster of paris.

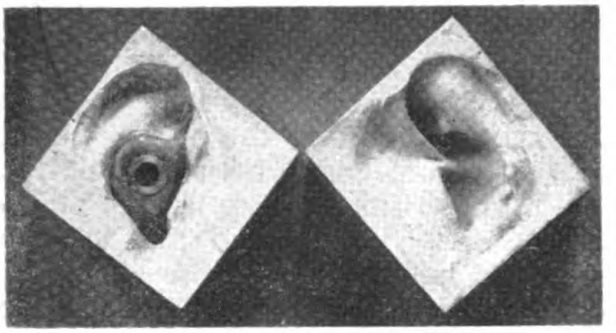


FIGURE 5. Stone model and waxed case.

Separating. Place the flask in boiling water for five minutes and separate. Wash all wax clear of models, and while the case is still hot a little acetone may be used to remove any remaining wax or grease. The acetone immediately volatilizes.

Packing. When the case is cooled and ready for packing, a water glass solution or 40 percent coconut oil soap is used as separating medium. Apply the separating medium to the entire mold surface of the negative half of the flasked case and to the flat surface of the positive half. When water glass is used, care must be taken to avoid coating the ring. Water glass on the ring will not permit a good union of the acrylic to the metal and will result in its becoming loosened in the finished ear mold.

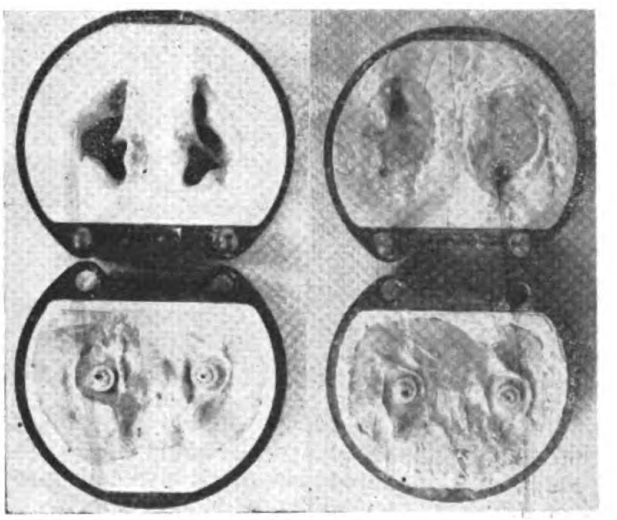


FIGURE 6. Flasked and packed before final closing.

The case is then packed and tested in the usual manner using a good clear dental acrylic (figure 6). The flask is closed tightly and cured under spring pressure. It is best to use the gradual run up and long cure for a clear acrylic free from bubbles.

Separating and polishing. After curing, the case is separated and polished carefully. The ring surface must not be abraded, and accuracy of the canal extension and all surfaces within the ear proper must be maintained.

Boring the canal. A hole must be bored from the base of the

ring through the canal-extension for a sound channel. A round, straight handpiece bur of suitable size is used. It is first necessary to grind the body of the shank down for a considerable distance back. The shank then being smaller than the head will permit angulation and guiding to a limited extent. Because of the angles of the canal, the hole must be bored in two operations. Starting at the tip the hole is bored halfway through the canal-extension length toward the ring, or whichever distance is suitable so that it may later make a junction from the opposite angle. The second half of the canal is then drilled through from the base of the ring to a junction with the first hole. While drilling, the bur should be moved in and out to keep cleared of ground material, and overheating must be avoided or balling up of the acrylic will occur on the bur head. Vision must not be depended upon in this operation, as light is distorted by the acrylic material. Angles of the bur itself are the only positive factors. Canals vary greatly in circumference and length. The hole must be commensurate. Size of the hole is not essential to success with the hearing aid. It is better to leave sufficient material for strength and avoid creating thin places in the walls of the canal. In some instances it may be necessary to cut off a good portion of the tip of the canal-extension in order to obtain an angle necessary for accomplishing the hole. It is desirable, though, for the most efficient operation of the hearing aid that the mold go as close to the drum as the patient can tolerate with comfort (figures 7, 8, and 9).

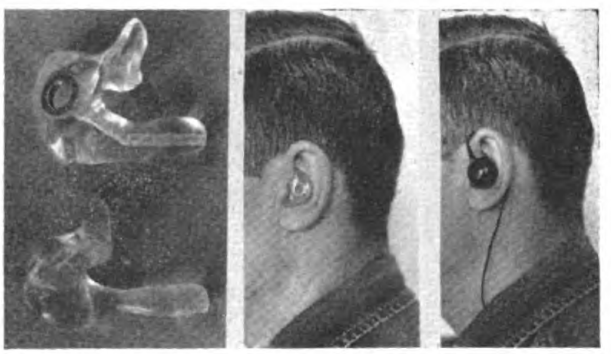


FIGURE 7. Finished plastic ear mold.
FIGURE 8. Finished plastic ear mold in position.
FIGURE 9. Completed case with receiver attached.

Spring. Stone or acrylic which remains in the ring groove is removed with a small instrument and a spring inserted so the receiver will snap on and off. It is important that a seal be obtained between the ring and the receiver, for if leaks occur the receiver will "squeal."

Adjustments. If the canal is too long, it will cause discomfort, particularly when the user yawns or opens the mouth wide. It may be cut off and repolished. All sore spots should be relieved. It is sometimes necessary to dress down the canal portion a slight amount. If definite sensitivity to the acrylic substances occurs, the material must be changed and another type used. Cellulose acetate, vinyl resins, or vulcanite are suitable substitutes.

Vol. IV
No. 5

Water Supply at a Base Unit in China

MAJOR CLIFTON BOVÉE
Sanitary Corps, Army of the United States
CAPTAIN JULIUS J. SACHS
Medical Corps, Army of the United States
and
MAJOR JAMES B. MONTGOMERY
Medical Corps, Army of the United States

Because of difficulties of air supply over the "hump" route and the lack of well-drilling facilities, ground-water resources in China cannot be used. Army installations have had to use surface water from shallow dug wells or drainage ponds fed by rice paddy or storm runoffs. These types of raw surface water are characterized by high turbidities and gross pollution with waterborne pathogens. Most surface water sources in China are essentially equivalent to sewage-polluted supplies, and gastrointestinal disease among the indigenous population keeps this transmission link highly contaminated.

Prior to installing the surface water treatment plant at the base under discussion, water purification consisted solely of boiling. Figure 1 shows a primitive boiling unit. Water in wooden buckets is carried by coolies from an open, dug well and poured into improvised oil-drum heaters. A charcoal or wood fire provides the heat; but with the small heating area at the base of the drum, an intense fire is required for a long time to bring the water to a boil. Distribution of the water from these drums to the various points of use is then performed by coolies in the same manner as the filling. The process is entirely in the hands of coolies, and it is questionable whether or not the water is always heated to boiling point. If boiling is properly done, low bacterial counts can be expected. Table I shows that this was not the case. Secondary contaminations of the boiled water are the rule when the boiled water is distributed by coolie labor to kitchens and washroom containers. Another limitation in the purification of these water supplies by boiling is that the finished water is neither palatable nor pleasing in appearance, for the organic content is merely cooked and the sediment is not removed.

The only argument in favor of properly boiled water is that cysts of *Endamoeba histolytica* present at the time of boiling will be destroyed; however, it is not generally realized that where secondary contaminations of the water occur in distribution prior to consumption, reintroduction of the cysts

FIGURE 1. Typical installation for purification of water by boiling.

cannot be overcome even though chlorination is subsequently applied. Some objections to the practice of boiling water are: (1) Boiling is not well adapted to the needs of permanently quartered troops as it requires a great deal of time, labor, and equipment to provide the requisite amounts each day. (2) It

TABLE I

Records of water reports
(Purified by boiling)

Date	Source	Lactose fermentation			Average bacteria count per cc.
		10 cc.	1 cc.	1/10 cc.	
24 Aug. 43	Table	x	x	—	305,000
	Drum	x	x	—	26,000
19 Nov. 43	Mess	—	—	—	166,050
11 Dec. 43	Mess	x	x	x	8,250
9 Feb. 44	Tent	x	x	—	900
23 Mar. 44	Mess	x	x	x	2,300
21 Apr. 44	Mess A	x	—	—	95,000
	"A" drum	x	—	—	43,000
23 June 44	Mess A, water bottle	—	x	—	50,000
	Mess B, cooled water from boiling drum	x	—	—	100
2 Aug. 44	Mess B, water bottle	x	—	—	23,700
	Mess C, water bottle	x	x	—	86,000
	Mess B	x	x	—	36,000
15 Aug. 44	Mess water bottle	x	—	—	34,200
30 Aug. 44	Mess A, water bottle	x	—	—	30,250
	Mess C, cooling drum	x	x	x	116,000
	Mess ATC water bottle	x	x	—	57,400
13 Oct. 44	ATC mess storage drum	x	x	—	14,250
	Mess C, storage can	x	x	x	2,800
	Mess A, storage drum	x	x	x	42,900

is believed that the large amounts of sediment in boiled drinking water from these surface sources act as a mechanical irritant to the gastrointestinal tract with resultant diarrheas. (3) Since, in China, the provision of drinking water is a function of the Chinese War Area Service Command hostel service, proper supervision of the large numbers of coolie help required for boiling and distributing the water is impossible. That secondary contaminations inevitably occur in rehandling is indicated by the bacteriologic analyses made. Table I is a recapitulation of the laboratory findings on the drinking water provided Army personnel prior to the installation of the treatment plant.

Considerable opposition to the water plant to be described was raised because of doubt of its ability to remove encysted *Endamoeba histolytica* from the raw water. Although the knowledge is widespread among military men that boiling will destroy these cysts, a common misconception is that this is the only effective method. Filtration will remove the cysts of *Endamoeba histolytica* from a water supply. Municipalities have dealt successfully with this problem for many years by using slow sand filtration when forced to deal with polluted surface supplies, but these methods are not generally known throughout the Medical Department. Unfortunately, objective test data capable of showing conclusively the presence or absence of amebic cysts in raw and finished water samples were not obtainable in a theater of operations, and the merits of several treatment stages could only be validated on the basis of empirical considerations based on the sanitary engineering principles involved.

METHOD USED

The water source developed for this installation is an open, dug well, 10 feet in diameter and about 40 feet deep. The water is highly contaminated and very turbid, with suspended blue clay. The daily yield from this well falls so low during the dry season that it must be supplemented with ditch water hauled by tank trailers from surface ponds nearby. The well is then used merely as a ground reservoir with the ditch water dumped into it from the trailers. From this, well water is lifted by a 55-g.p.m. Jaeger pump set to a 4,100-gallon treatment tank fabricated on the spot from wood and scrap aluminum obtained from local salvage. After treatment, the water is pumped by a similar pump set through twin pressure filters fashioned from locally available materials. The filtered water effluent is forced up into two overhead tanks having a combined capacity of 7,000 gallons' storage. These tanks, mounted on a trestle, distribute finished water by gravity into the distribution system. The plant layout is shown in figure 2.

Raw water pumped into the treatment tank enters through a small drum overhanging the tank in which the coagulant chemicals necessary for each 4,100-gallon batch are held in lump form. The incoming water picks up these chemicals slowly, falls through a perforated bottom to a collecting spout, and is then discharged into the treatment tank in a manner to impart a rotary motion to the contents as the tank fills. Crystal ammonium alum is applied at a fairly heavy dosage of 6 grains per gal-

lon and soda ash is used as required to keep the resultant pH near 6.5 for optimum coagulation. During the tank filling period, calcium hypochlorite is added in the batch method by suspending, under the influent stream, a perforated can containing the proper charge. Prechlorination is applied to obtain a 2 p.p.m. residual of free chlorine. Six ounces of high test hypochlorite are normally used per 3,000 gallons of this raw water to obtain the desired residual, indicating a chlorine demand of 8 p.p.m. in the raw water. After the treatment tank has been filled, the rotary motion of the contents slowly subsides, and floc agglutination and sedimentation begin. The water is then allowed to remain quiescent until sedimentation has progressed to the desired point. At this stage, pumping to the filters is begun, taking the water from an outlet near the bottom of the treatment tank. The sludge formed in the treatment tank during sedimentation is allowed to accumulate until it builds up to the outlet orifice, since

FIGURE 2. Layout of treatment plant installed.

its action is very beneficial in the treatment of successive batches of water.

The filters in use were constructed from 55-gallon oil drums. Water enters at the top and is distributed over the filter surface by means of a baffle plate, consisting of a perforated drum top spot-welded in place below the discharge orifice. The water then passes through graded layers of filter material consisting of sand, pea gravel, and coarse gravel sections. The filtered water is collected at the bottom of the drum by means of a manifold constructed of pipe sections pierced with ¼-inch holes. Eight inches from the top of the filter shell is mounted a small petcock serving as an air vent. The cock is closed as soon as the water level in the filter rises to that elevation, thus providing an air bell in the filter head which acts as an air cushion to equalize the pump surges and pulsations. Effective filter surface area in the twin filters is about 5 square feet, with a discharge of 24 gallons per minute from the pump working against the filter resistance and a 25-foot discharge head to the storage tanks. Details of the filter construction are sketched in figure 3.

Postchlorination of the finished water is accomplished in the storage

tanks by the batch method, as indicated on the basis of frequent chlorine residual checks. Chlorine residuals are maintained at 1 p.p.m. at all times. Backwash of the filters is accomplished when necessary (about once weekly) by passing finished water back through the filter by gravity from the elevated tanks and allowing it to run to waste until it is clear.

Comprehensive operational logs are maintained embracing pumping rates, contact times, chemical dosages, pH, and chlorine residual test results. Normal output of the plant is around 10,000 gallons per twelve-hour day. The water produced is clear and sparkling, with turbidities estimated at less than 0.5 p.p.m.

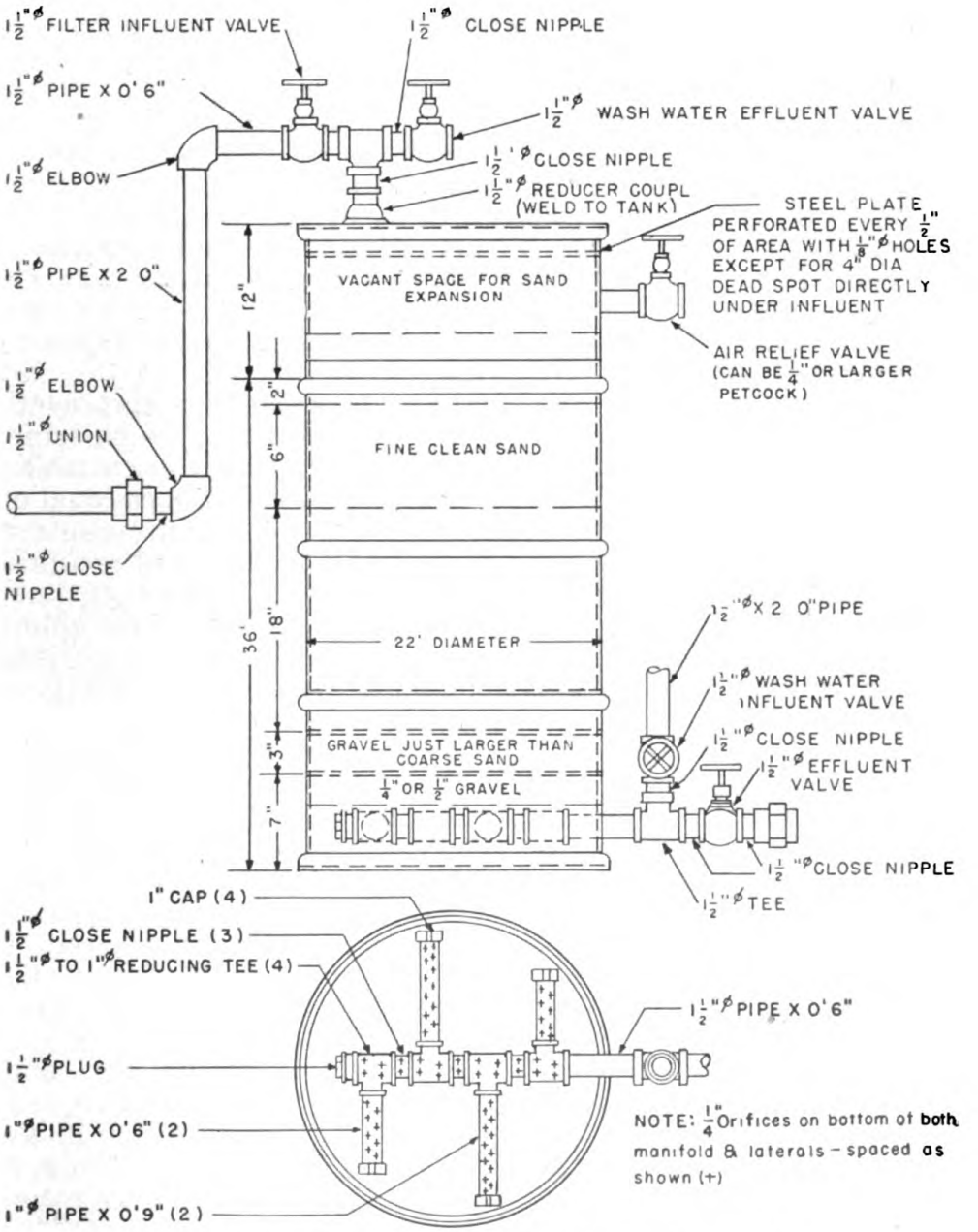


FIGURE 3. Diagram of pressure filter construction.

Finished water is piped by gravity from the storage tanks directly into the mess for culinary uses and table water. Water carafes are filled from taps just prior to mealtimes in a sanitary manner under supervision of Army personnel. Outside the mess hall, closely guarded standpipes are provided for men to fill their canteens and the water containers that are brought daily from the line and office buildings by jeep. Water is provided in the washrooms for oral hygiene purposes in containers filled and handled only by Army personnel.

DISCUSSION

The prime purpose of the water treatment plant is the removal of encysted *Endamoeba histolytica* during the process of producing a finished water. To accomplish this with certainty, a number of standard water-works practices based on accepted sanitary engineering principles have been incorporated in the operation of this plant. It is true that normal chlorination procedures offer no protection against *Endamoeba histolytica* in water and that rapid sand filtration and coagulation methods are each only partially effective in removal of this pathogen. However, by certain combinations of these three methods, carefully controlled, a potable water can be readily produced from a raw water contaminated with this organism. This is accomplished in this plant by the stages to be described.

First, an unusual chlorination procedure is employed. Encysted *Endamoeba histolytica* can be killed by free chlorine, the total mortality index following a definite time concentration curve within narrow pH ranges. Thus, a free chlorine residual of 15 p.p.m. will kill cysts within a five- or ten-minute contact period while, farther down on the curve, a maintained residual of 2 p.p.m. chlorine will kill at around a two-hour contact time. In the operation of this plant, a batch of water is held for about four hours during the treatment stage. During this period, free chlorine residuals are held at 2 p.p.m. following prechlorination of the water. This is one safeguard.

Coagulation and filtration are then combined to provide another efficient safeguard. On starting initial operation and after each backwash, about 1,500 gallons of coagulated, but only partially settled water, are run to waste through the filters. This has the effect of covering the sand filter surface with a jellylike mat of the aluminium hydroxide floc obtained in coagulation. Thereafter, each batch of water treated is started through the filters before sedimentation is essentially complete with some floc still suspended in the water. This maintains the filter surface mat in good condition. In action, this gelatinous filter layer works as an exceedingly fine biofilter, too fine to permit the passage of cysts, and tenaciously holding by its sticky adhesive action any particles which lodge against its surface. The formation and preservation of the mat have further been aided by reducing the normal Army rapid sand filtration rates to one-half or about 5 gallons per square foot of filter surface per minute and incorporating the air-

dome in the filter shells to level out pump pulsations and surges.

Pathogenic water-borne bacteria that may be present in the raw water are destroyed by the chlorination procedures applied. Contact times are ample with the prechlorination used, and 1 p.p.m. residual is maintained in the covered storage tanks with frequent checks made at service taps on the delivery lines to see that delivered residuals do not fall below 0.5 p.p.m. chlorine.

The final and extremely important safeguard has been the elimination of the threat of secondary contaminations by taking the drinking water supplies entirely out of the hands of native coolie labor. While chlorine residuals afford a measure of safety against subsequently introduced pathogenic bacteria, they are no protection against cysts of *Endamoeba histolytica,* which must be considered probable in any secondary contaminations occurring. The plant is operated by an Army technician. Army personnel obtain their own drinking water in canteens from guarded standpipes on the distribution lines. Drinking water supplies for offices and washrooms are obtained by Army personnel from these standpipes, and drinking water provided at the mess is obtained from mess taps under Army supervision. At no time do native coolies have

TABLE II

Records of water reports
(Treatment plant)

Date	Source	Lactose fermentation			Average bacteria count per cc.
		10 cc.	1 cc.	1/10 cc.	
18 Oct. 44	ATC well (raw water)	x	x	—	1,700
	ATC treatment tank (residual chlorine 2.0 p.p.m.)	—	—	—	300
	ATC storage tank (residual chlorine 0.5 p.p.m.)	—	—	—	100
	ATC finished water, outside mess (residual chlorine 0.7 p.p.m.)	—	—	—	800
	ATC finished water in mess from kitchen tap (residual chlorine 0.4 p.p.m.)	—	—	—	400
	ATC finished water No. 2 mess hall tap (residual chlorine 0.4 p.p.m.)	—	—	—	600
3 Nov. 44	ATC faucet	—	—	—	200
25 Nov. 44	ATC B mess	—	—	—	500
26 Dec. 44	ATC B mess	—	—	—	400
	ATC C mess	—	—	—	300
9 Jan. 45	ATC B mess	—	—	—	100
	ATC C mess	—	—	—	100
22 Jan. 45	ATC B mess	—	—	—	100
	ATC C mess	—	—	—	100
7 Feb. 45	ATC B mess	—	—	—	100
	ATC C mess	—	—	—	300

any contact with this water supply, and houseboys and others are subject to strict disciplinary action to prevent their coming in contact with drinking supplies.

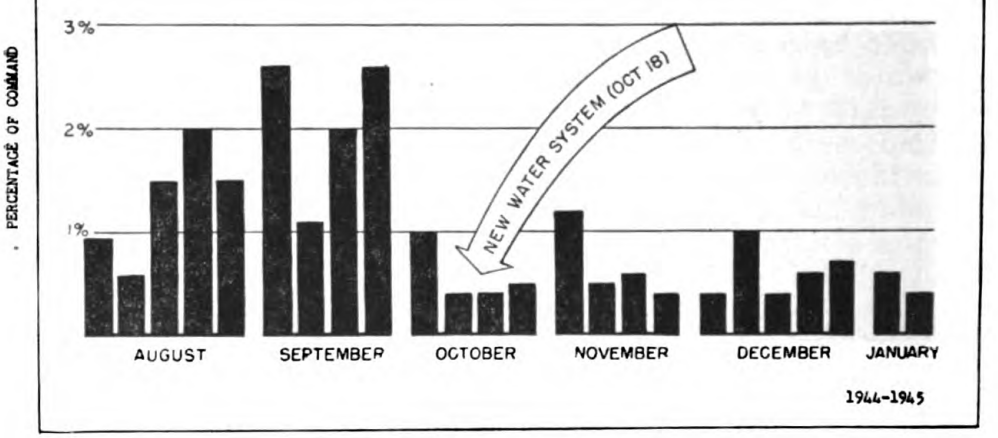
RECORDS

Table I summarizes a series of bacteriologic reports made from water samples taken before installing the present water system. Table II consists of returns made since the system has been placed in operation. It is apparent that the tremendous difference in the bacteriologic reports indicates conclusively the success of the present plant in coping with the contaminated raw water used.

To evaluate this water supply with reference to the health of the unit, the diarrhea morbidity was examined for a twelve-week period prior to installation of the system and a similar period following its use. The results of these records are charted in table III. The diarrheal diseases

TABLE III

DIARRHEA MORBIDITY



were reduced more than 50 percent. Although other factors may enter into this reduction, such as seasonal variations, it is believed that the improvement of the physical and bacteriologic quality of the water was the important factor. Facilities are not available in this theater for demonstrating cysts of *Endamoeba histolytica* in a water supply. However, since this water supply has been in operation, only one case of amebic dysentery has occurred and this was in a newly arrived enlisted man having a history extending back several weeks prior to reaching this unit.

SUMMARY

The water system described has been in operation at an Air Transport Command base unit since 18 October 1944. The plant applies treatment to the raw surface water used consisting of prechlorination, coagulation, sedimentation, and sand filtration. That the system is far superior to the boiling practices formerly used is evidenced by a comparison of the bacteriologic returns for both supplies, the lowered incidence of diarrheal diseases, and the crystal-clear, potable water produced.

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Epidemic of Acute Pharyngitis Due to Hemolytic Streptococci

CAPTAIN JOHN T. PEWTERS
Medical Corps, Army of the United States
and
MAJOR LEWIS T. BULLOCK
Medical Corps, Army of the United States

An epidemic of acute pharyngitis and tonsillitis occurred in November 1944 at the Lubbock Army Air Field which threatened to disrupt temporarily the training program of this advanced twin-engine flying school. One hundred and fourteen cases were admitted to the station hospital during an eight-day period. Forty-seven cases were admitted on one day. This amounted to a rate of 2,018 cases per 1,000 troops per year if calculated on a week of the epidemic.

The symptoms and clinical findings were similar in all cases. The onset was rapid, starting with sore throat, fever, and malaise. The severe sore throat was accompanied by dysphagia and severe prostration in many cases. The temperature was usually between 101° and 103° F. and ranged between 100° and 105° F. Marked edema of the tonsils, uvula, and pharynx with a dusky red color and, in almost all cases, small yellow spots of exudate on the tonsils or pharyngeal wall were present. The submaxillary lymph nodes were usually enlarged and tender. In 22 cases the white blood counts ranged from 10,600 to 15,500. The fever subsided by lysis in forty-eight to seventy-two hours and the sore throat gradually improved.

Throat cultures were taken on 66 patients and sent for typing to the Rheumatic Fever Control Laboratory at the Amarillo A.A.F. Regional Hospital. About one-half of these were taken after varying amounts of sulfadiazine had been administered. Fifty-five of the cultures, or 83 percent, were positive for group A hemolytic streptococci. Fifty-one of these were type 30, 2 were type 19, and 2 were type 26. Of the 11 negatives, all had been treated with sulfadiazine for one to three days before the culture was taken.

All patients were treated with bed rest, forced fluids, and sulfadiazine. Two and one-half gm. of sulfadiazine were given initially followed by 1 gm. every four hours. Sedatives were used as needed to control the sore throat and dysphagia.

Recovery was rapid and complete. Three patients developed mild injection of the eardrum, which subsided with-

out drainage or disturbance in hearing. No patient had a rash. Moderate enlargement of the cervical nodes persisted in 6 cases. Two patients developed transient albuminuria and hematuria without rise in blood pressure, which could well have been from the sulfadiazine. All patients were examined weekly for six weeks with a urinalysis on each examination. After three months there were no resulting cases of rheumatic fever or nephritis.

MANAGEMENT AND CONTROL

On the third day of the epidemic, when it became apparent that it was serious, four medical officers were on duty in this 100-bed hospital. The staff, in the absence of the surgeon, energetically attacked the problem and instituted the following control measures:

1. All patients possible were evacuated from the hospital.
2. The civilian dependents were evacuated to their homes in Lubbock, and the maternity ward was closed.
3. Outpatient services for dependents were discontinued.
4. Visitors were barred from the field.
5. The post theater and the post exchange restaurants were closed.
6. Classroom activities and other gatherings were suspended, except for cadet classes.
7. Physical training, except for cadets, was discontinued.
8. An inspection by the Eighth Service Command sanitary inspector was arranged. He reported that ventilation and all other sanitary conditions were adequate.
9. The surgeon of the Central Flying Training Command was notified.
10. Sulfadiazine prophylaxis was initiated. All ground personnel received 2.5 gm. for two days, 1 gm. for five days, and ½ gm. for fourteen days. Flying personnel, including cadets, received 1 gm. daily for seven days and ½ gm. for fourteen days.
11. The regional medical consultant from Amarillo was requested to visit the field.
12. An epidemiological study was initiated. This included a questionnaire indicating the squadron, barracks, mess hall, and day of onset for each patient.
13. The milk and water supplies were studied and found negative.
14. The mess halls were particularly investigated. Remaining food was examined and all dishes were sterilized with extra heat and run twice through the sterilizing machines.
15. The dentists were mobilized to assist particularly in the examination of troops.
16. All troops eating at consolidated mess No. 2 were examined daily to detect early cases. Questionable cases were referred by the dentists to the doctors at the hospital for examination.

EPIDEMIOLOGY

The curve of the epidemic is indicated in table I. There were 11 scattered subsequent admissions from 6 November 1944 until 1 January 1945.

TABLE I

Date	Admissions
28 Oct.	0
29 Oct.	1
30 Oct.	11
31 Oct.	15
1 Nov.	47
(Prophylactic measures instituted)	
2 Nov.	27
3 Nov.	9
4 Nov.	3
5 Nov.	1
6 Nov.	0
Total	114

The personnel and the buildings of this field are divided into six distinct groups, each centered around a different mess hall. Each group is separated 100 yards or more from the others. The cadets (group 1), the officers (group 2), the WACs (group 3), the hospital (group 4), and the colored troops (group 5), have each an isolated group of barracks with a separate mess. The largest group of barracks (group 6) surrounds a consolidated mess and is used by four squadrons. These are permanent party troops working in offices and on the line. There is intimate contact with the other groups in daily work, but the messing is separate.

All but 3 cases in this epidemic occurred among the troops in group 6. There was one each from groups 1, 4, and 5. None of these had positive throat cultures and it seems probable that they were unrelated respiratory infections occurring at the same time. The number of cases occurring among the four squadrons in group 6 was roughly proportional to their strength. The number of cases per 100 troops in these squadrons was 2.6, 4.4, 7.2, and 8.4.

The cases admitted each day of the epidemic were plotted on a map of the field, according to barracks. There was no concentration in any one barracks or any spread from a particular barracks. The hospitalized men lived diffusely throughout the barracks of group 6.

The milk used is pasteurized and received in half-pint bottles. The same dairy distributes milk to all messes. Study of the milk and water showed no abnormal bacteria.

The epidemic appears to have arisen in the consolidated mess of group 6. The personnel of this mess were studied, and no evidence of recent respiratory disease was found among permanent personnel. Throat cultures were uniformly negative. It was not possible to study all the previous temporary K.Ps. There was no history of a particular suspicious food being served just before the epidemic started. All food served just before the epidemic had been discarded when the epidemiological survey was instituted, and bacteriologic study of these foods could not be made.

The original spread of this infection was apparently not from personal contact. The value of the sulfadiazine prophy-

laxis cannot be determined. The sulfadiazine and other prophylactic measures may have been of some value in preventing a spread from the troops apparently originally infected from food to other troops by personal contact.

CONCLUSIONS

This epidemic probably arose from contaminated food served in one particular mess hall, although bacteriologic proof could not be obtained.

All medical officers should be familiar with procedures for the control of such an epidemic from any method of origin. The staffs of all hospitals should plan the measures of prevention, control, study, management, and treatment to be instituted.

The Venereal Disease Control Interview

MAJOR EARL C. VAN HORN
Medical Corps, Army of the United States
and
STAFF SERGEANT ORLAN L. SAWEY

In order to gain information on sex contacts, all venereal disease cases diagnosed at Camp Atterbury since August 1942 have been interviewed in a central office. Originally, enough information to locate the source of the infection, an "adequate" referral, was obtained in a relatively small number of cases. An attempt was made to analyze and improve the procedure and method of interview and, as a result, the Fifth Service Command Quarterly Evaluation Report for April-June 1944 gave this station credit for 85 percent "adequate" referrals. The method and procedure of interview which have been found successful will be described. The instructions on W.D., M.D. Form No. 140 state:

> The name and description of the contact and of the place where she may be found are the data which will enable the health officer to find her and place her under supervision. Data relative to the circumstances of encounter or procurement will be very helpful to law enforcement agencies. Don't be satisfied until you secure information which you think would enable *you* to find her and to locate the place of meeting. One good contact history may prevent countless new cases of venereal diseases.

Since an enlisted man can speak more in the language of the soldier and hence readily gain his confidence, all interviews are done by a noncommissioned officer thoroughly instructed in the nature of venereal diseases and the purpose and aims of venereal disease control. The interviewing of enlisted men by medical officers was found unsatisfactory because of the poor rapport established in the time available. The skill of the interviewer often determines the success of the inter-

view. Many times an interview consists of a battle of wits between the patient and the man doing the contact history, with the patient striving to conceal information and the interviewer trying to persuade, not trick, him into cooperating. This skill is obtained only through continued effort and experience and, for this reason, it is important that a man who is to do venereal disease interviews be assigned to this duty long enough to acquire the necessary skill.

All interviews are done in a private room set aside for that purpose. Since most soldiers resent having their private lives known by everyone in the barracks, privacy is absolutely necessary. Few soldiers will cooperate when interviewed about sexual contacts while others are present.

An important factor in producing consistently good contact referrals is a thorough knowledge of the locality surrounding the camp. In our interview office, we have regular printed maps of all neighboring towns, and in addition we prepared our own detailed maps of downtown Indianapolis, showing all taverns, hotels, and various potential "hot spots." With these maps and the telephone directories, it is easy to locate a tavern or hotel by the history obtained from the soldier. Many times these maps, used with facts known by the interviewer, can either verify or disprove the soldier's story. We have also detailed road maps of all states for checking the locations of small towns in outlying districts in order to avoid errors in reports made to these districts. We have an informational file, indexed under first and last names, obtained from previous interviews and investigations, and a "rogues' gallery" of pictures obtained from police departments through the cooperation of the provost marshal.

The type of approach used in each interview is governed by the background of the soldier. A fairly complete picture of each individual can be obtained from his clinical record, which gives his name, grade, Army serial number, organization, age, race, nativity, and length of service. Information should also be obtained as to previous venereal disease history, marital status, and educational background. A good routine approach in interviewing a soldier is a discussion and explanation of the nature and treatment of the disease with which he is infected. It is here that the soldier gains information which will help him understand what he must do to be completely cured. This approach gains his confidence and he is more willing to volunteer information about his contacts. A few simple general rules followed in our interviews are:

1. Do not act superior to the soldier. A sympathetic attitude is important; the soldier must understand that it is the job of the interviewer to help him.

2. Use a blank sheet of paper. The soldier should not think that the epidemiologist is just "filling out a form."

3. Write out the information as quickly and briefly as possible. The soldier may change his mind about continuing to give information if he feels that everything he says is being written down.

4. Do not antagonize the soldier. If you intimate in any way that he is lying, he will lie all the more to prove that he is not a liar. If you feel that the soldier is being untruthful, use a different approach. Make a concentrated effort to gain his confidence.

5. Impress on the soldier that it is his duty to cooperate in order to keep someone else from getting the disease and in order that the girl herself may receive treatment necessary to her health.

6. Explain carefully that the interview information is confidential and that under no circumstances will the soldier's name be given in the subsequent investigation.

7. Explain that the Army does not make the investigation and that the matter is handled diplomatically by the proper health authorities.

Questions, worded in language which the soldier uses, are asked in the following order (this approach has been found more practical than the order in which the information is entered on M.D. Form 140) : When did the soldier's symptoms begin? When was the last time he left the post? This is valuable information which can be used to substantiate the soldier's story, as it can often be checked accurately. When did he last make a sex contact? When were the other contacts during the incubation period? Referring to the last contact, where did the soldier meet the girl? Where did the soldier contact the girl? What did the soldier call the girl; i. e., what were her name and nickname? What did the girl look like? Where can the girl be found? Where does she work? Does anyone else know the girl? Do any of his friends know her address? How much was the soldier drinking? What prophylaxis, if any, did the soldier use?

The last eight questions should then be repeated for all contacts within the incubation period of the disease. Most soldiers when immediately asked the name of the girl tend to "freeze up" and evade all questions. He is never asked who he thinks gave him the disease, but all contacts within the incubation period of the disease are obtained. The questions are naturally worded in the language of the soldier. The vernacular is much more effective than scientific or grammatically correct terms and helps to gain his confidence. The first few questions are feelers. If the soldier, when asked where he met the girl, evades the question, no more questions are asked until the interviewer is sure that he has gained the cooperation of the soldier. As much as possible, he is never allowed to commit himself to vague information. In most instances, drunkenness is only an excuse for giving such information. It is relatively easy to tell from the character and speed of the response, as well as from the facial expressions, whether or not a soldier is truthful.

Adequate information has been obtained in some instances by taking the soldier to town with an investigator and locating places of encounter and exposure. The soldier is never employed in this manner actually to find or point out the girl, but is used only to obtain a correct address. In obtaining descriptions, ask for approximate ages, heights, etc. Most important are unusual characteristics in appearance, dress, and speech. Few soldiers can give exact descriptions of the casual pickup. In most instances, if the soldier is able to give an accurate decription, he is also able to give a good name and address; however, in the absence of name and address, the place of encounter and the description of the girl are the only clues that will help an investigator find the contact.

In cases of prostitution, we place emphasis on the procurement history. This includes descriptions of pimps, "madams," and taxi drivers. This information on illegal activities, if accurate and complete in detail, is less likely to be considered insufficient information by the health and law-enforcement investigators.

Since the questions about the soldier's drinking and about prophylaxis come last, he is given little opportunity to use drunkenness as an excuse for vague information. He is told, in gonorrhea cases, of the effect of drinking and sexual intercourse on the cure and spread of the disease. He is given opportunity to ask questions about venereal disease, and it is at this point that he receives individual education which will prevent his being a casualty again. Here also information can be obtained as to where the educational program is unsuccessful.

The above outline is only a general procedure which has been found effective. Different soldiers require different methods. When the interviewer has obtained the cooperation of the soldier, he will usually be able to obtain enough information to locate the source of infection. He should never be satisfied until he secures information which he thinks would enable *him* to find the contact and the place of encounter. If that much information is not obtained, the interview is unsuccessful.

SUMMARY

By emphasizing the technique of interview, we have increased the percentage of "adequate" referrals. Interviews should be done by an adequately trained enlisted man, who has at hand complete information on the surrounding locality. Interviews should be private. Each soldier should be interviewed as a man, instead of as a case of venereal disease. His cooperation is important. The interviewer should not be satisfied with less than enough information to locate the contact. The soldier has that information. The personal interview presents a good opportunity for soldier education.

Reconditioning Program in an Overseas General Hospital

CAPTAIN PAUL KUNKEL
Medical Corps, Army of the United States

A reconditioning program was established in this hospital in April 1943. The objectives are to return fit personnel to duty, re-educate those with a disciplinary problem hiding under the cloak of illness, check the diagnosis of the ward officer, evaluate the limitations placed on individuals by an organic lesion, restore confidence and health by early disposition and active treatment, and preserve the morale of patients awaiting evacuation to the United States. In the latter group, psychotherapy, physiotherapy, graded physical exercise, strict discipline, and occupational therapy are instituted.

The area for those who are to return to duty is isolated in this hospital to prevent these soldiers' associating with those on wards or awaiting transportation to the homeland. These soldiers wear "fatigues" and are quartered in tents. Facilities are provided for baseball, touch football, volleyball, basketball, horse shoes, ping-pong, boxing, and bag punching. Gardening and carpentry tools and a tractor are provided. The program is directed by a medical and a surgical officer assisted by an infantry officer and seven noncommissioned infantry officers who supervise 200 men. All patients who have been hospitalized more than a week and who will return to a combat unit must participate in the reconditioning program; others not in combat units who are unable to continue duty for any reason are frequently enrolled. Before assignment to the program the patient is studied by the ward officer, who makes recommendations. When enrolled, he is informed that he is no longer in the hospital and will again take up the rugged life of a soldier. He is given no medication or sedation. He never sees his ward officer again unless so requested by medical officers in charge of the reconditioning program.

Sick call is compulsory each second day, after activity, and it is there that the patient's complaints and the recommendations of the ward officer are evaluated and the patient treated. The patient who complains of swelling of his legs after a hike is taken on a 15-mile hike and then examined. Those who complain that their joints become red, hot, and swollen with exercise, are exercised and evaluated. Should the test of activity reveal incapacitating emotional or physical responses, the patient is returned to his ward officer for

further treatment. An infantry officer and noncommissioned officers were found to be superior in ability to command the soldier to do what the medical officer asked of him. Once the cadre believed in and understood the objectives of the medical officer, they exercised their ability in commanding men. One intensely personal and sympathetic sergeant was placed in command of the weak, convalescent, typhus patients and the psychoneurotics who need encouragement and gentle pressure. Two Southerners commanded the colored. One fiery, clever, and determined sergeant commanded those with disciplinary problems. Patients who deliberately exaggerated or pretended to be ill for the purpose of avoiding duty will be referred to as the "malcontented." This sergeant became effective in handling this group only after he was satisfied that the medical decisions concerning the ability of these individuals to do the job assigned were considered and usually accurate.

MEDICAL SUPERVISION

The program allots time for calisthenics, athletics, hikes, varied work details, and rest and recreation. There is complete medical supervision of all activities. The patients are divided into groups, the physical requirements of which vary, and progress through the groups as their physical and mental stamina increases. The average stay ranges between three and seven weeks. Complete military formation with roll call is held at reveille and retreat, and before and after each period of activity. Tent and personnel inspection are held immediately after breakfast. All phases and aspects of military courtesy and discipline are rigidly enforced and, when the occasion demands, small groups are given classes in these subjects.

Up to 1 May 1944, 22 percent of the total admissions enrolled in the program. They represent 31 percent of those returned to some form of duty. No more than 3 percent have been "boarded" after enrollment. This low figure is a high tribute to the ward officer who selected those patients who he felt should be able to do duty.

The reconditioning program has furnished a basis on which line organizations may operate in obtaining useful services from soldiers who complain of illness. After investigation in the hospital, the reconditioning program proved that the soldier could work or that a specific limitation should be placed on his work.

Since patients acutely ill usually did not gravitate to the general hospital, the patient who came through the evacuation chain of hospitals frequently had learned bad habits. Too often, from the first day in hospital and for the ensuing several months, he had been excused from all discipline. He had developed a convenient symptom pattern, was lazy, and firm in his belief that if he continued to ache, limp, or vomit, he would be "boarded" home. Often he had been informed in

previous hospitals of his probable disposition. He arrived by ambulance, shouldered his barracks bag, and demanded direction to the post exchange.

Organic disease was the least difficult to manage. Scrub typhus patients may retain a labile vasomotor apparatus for several weeks. Those seen here had lost much weight and strength and had less stamina than any other group. The majority of their symptoms were conditioned by undue attention to their hearts in the admitting hospitals. Graduated exercises indicated that their exercise tolerance could be built up rapidly. As an instance, one group had a slower pulse rate after a short hike than before it. They gained weight normally and were successfully rehabilitated. Patients who were filariasis suspects were exercised vigorously. Physical activity frequently reproduced the manifestations of this disease and thereby determined disposition. Those with simple varicoceles were unaffected. Skin diseases were observed under exercise and conditions of sweating while the soldier worked at dusty jobs. If trichophytosis was uncontrollable or seborrhea recurred, the patient was returned to the ward. Patients with indigestion, whose gastro-intestinal x-ray examinations revealed no abnormality, were commanded to carry on with increasing activity on a regular diet. They usually gained weight and stamina. Patients with strains and sprains, new and old, were given graduated and corrective calisthenics under supervision until free of pain. Patients with mild asthma were exposed to dust and pollens of the fields during long hikes, and their disposition was recommended on the basis of the objective findings. The actual improvement in this entire group—their weight gain, stamina, appearance, and well-being—was striking.

The psychoneurotics require refinements of management, with emphasis on mildly tiring physical exercise and encouragement. Later, long interviews to discover the conflicts or to enlighten the patients as to the genesis of their symptoms may be applicable. Forceful re-education is employed when they are fully convalescent. The psychoneurotic is genuinely ill. At any task he works diligently until it is finished, and he tries to do it well. The more intense his efforts, the more prominent his symptoms, in addition to other stigmata such as dilated pupils, cold and moist palms, tremor, tachycardia, sweating, rapid shallow respirations, and obvious fatigue out of all proportion to his output of energy. He has usually been stalled on the wards in the evacuation chain of hospitals for months, eating poorly, sleeping in the day, and receiving sedation at night. Under the physical routine of the reconditioning program, he regains his appetite, rearranges his sleeping habits, gains weight, strength, and ambition, and develops confidence, insight, and a desire to soldier. Occasionally, a severe psychoneurotic develops more anxiety under the routine and is returned to the ward for disposition.

THE NO DISEASE GROUP

The "no disease" group taxes our ingenuity to the utmost. Hospitalization in this group is not always the fault of the soldier. Errors in judgment and lack of courage by the medical officer in addition to poor diagnostic facilities may be responsible. Usually this group is composed of the disciplinary problems and the "malcontented." The first interview with this group has proved a valuable diagnostic aid. The patient's arrogance, defiance, surliness, and avoidance of military courtesy and discipline during his efforts at selling his symptoms are characteristic. He demands treatment more or less at his own direction and convenience. When commanded to perform a task, he does not try, does not finish his job, and becomes surly, critical, and indignant. He may threaten to sue the physician or hospital, write his congressman, and expose his inhumane treatment by the printed word and often may demand an interview with the Inspector General. He is usually well nourished and healthy and has none of the physical stigmata of psychoneurosis, such as tremor and wet palms. He is detected by his behavior even before he is seen to lose his limp while running for the "chow" line, or to stand erect for the first time in the shower bath. He frequently assumes a posture or behavior pattern that is extremely uncomfortable, and, if observed over a long enough period, is unable to maintain it. Athletic contests or distasteful work such as transporting garbage usually facilitates making the diagnosis. A crafty and sometimes criminal type may defy diagnosis for weeks until exposed by several brisk medicine ball "workouts" after lunch. Immediate suggestive therapy after exposure in front of the group effects a miraculous and permanent cure. Distasteful details such as denial of post entertainment, post exchange privileges, passes, and sick leaves form an important disciplinary armamentarium for the medical officer in charge. The "malcontented" with habit vomiting without loss of weight or strength or signs of vitamin deficiency, ordered on a 15-mile hike with the medical officer, has it proved to him that he can make the hike with a stomach tube in place. The "malcontented" with diarrhea without demonstrable cause learns that he can do whatever is asked of him without weight loss or loss of strength.

Occasionally individuals are seen who entered the hospital with organic disease, developed anxiety, reactive depression, loss of will, and a conscious desire to avoid military duty. This sequence may be arranged in any order, but at any given time one predominates. Demanding activity, strict discipline, and subjection to a routine also frequently changes and reverses the predominant pattern. Treatment follows the methods outlined above. Many new facts are discovered by medical officers in the reconditioning area, but insofar as possible the recommendations of the ward officer are carried out and

his original diagnosis adhered to with qualification only in the progress notes.

The patient suffering from organic disease is found to exhibit true concern and alarm and is anxious to have something done for him. He will accept and believe that all measures are employed for his cure and rehabilitation and will be happy when they are complete. The psychoneurotic tries hard, finishes his job, and improves with suggestion and graded increase in activity. The hysteric is peaceful and placid and views the situation and the efforts spent on him with true amusement. The "malcontented" presents his symptoms forcibly and with belligerence and must be exposed. The rarely found recalcitrant individual is carefully studied and evaluated and the motivating factors considered. Because of the public nature of the challenge and the influence on the entire group, the necessary measures are employed to make him a model soldier instead of avoiding the challenge.

The results of the reconditioning program have cut the readmissions to this hospital for the same symptoms to a negligible number. Those who have gravitated back through the hospital evacuation chain have been reduced by the same magnitude. The demands it has put on the soldier to perform his military duties are known all along from the advance base to this general hospital. The soldier who is again hospitalized after return to his organization is promptly returned to duty, because it has been proved here that he is capable of doing duty. This is further evidenced by the fact that not more than 3 percent of the total enrollment have been "boarded" in this hospital.

Outdoor hobby shop at a station hospital on New Guinea. Signal Corps photograph.

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Apparatus and Clinical Notes

PENICILLIN MOUTHWASH FOR TREATMENT OF VINCENT'S STOMATITIS

CAPTAIN GUNTER SCHMIDT
Dental Corps, Army of the United States
and
CAPTAIN SEYMOUR A. HORWITZ
Medical Corps, Army of the United States

A penicillin solution used as a mouthwash has proved successful in this clinic in the treatment of twelve cases of Vincent's stomatitis. The method was inaugurated for two cases which did not respond to treatment commonly accepted as successful.

The solution was made up in a strength of 200 units of penicillin per cubic centimeter of normal saline solution. When refrigerated, it retained its effectiveness for at least one week. The method of treatment was as follows: The patient, while in the chair, received enough penicillin solution for one mouthful. He held this mixture in his mouth for one minute, moving it to all parts of the oral cavity. He then received one bottle with two ounces of penicillin mixture and was instructed to use this as a mouthwash every four hours, for one minute, in the same manner as in our office. On the following morning he returned to the clinic for examination and, if necessary, the same treatment was repeated until the condition cleared up. No other drug was used after penicillin treatment was undertaken. The advantages of this treatment are:

The simplicity of a mouthwash, which the patient can use himself without difficulty. The nonirritating properties of penicillin, which does not damage the gingivae. It seems rather to aid in the regeneration of damaged tissue. The treatment causes no discomfort.

Case Reports

CASE 1. A patient, aged 21, came to the dental clinic on 24 October 1944. His gingival tissues were hyperemic; necrosis had advanced to a stage where almost all the interdental gingival papillae had disappeared in the upper and lower anterior region. His breath had a fetid odor. He appeared slightly toxic and complained of severe pain in the mouth. A diagnosis of Vincent's stomatitis was made. The necrotic areas were treated with chromic acid in a dry field and the mouth rinsed with hydrogen peroxide. The patient was given sodium perborate to use as a mouthwash every two hours during waking hours. On the following day the condition was slightly improved, careful prophylaxis begun, and sodium perborate mouthwash continued. On 26 October complete calculus removal was done, and the patient was advised to continue sodium perborate mouthwash. On 16 November he was seen again. He had discontinued sodium perborate mouthwash, and his condition was worse. Chromic acid and hydrogen peroxide were used as before, and the patient was admonished to use sodium perborate under supervision in the clinic three times daily. This treatment was continued daily until 5 December without much improvement. On that day tincture of merthiolate was used, and sodium perborate mouthwash was continued three times daily. No improvement was noted. On 18 December Castellani's solution was employed and sodium perborate continued three times daily. On 23 January it was necessary to use chromic acid again, and this treatment was continued daily until 31 January. From that date until 1 March,

Castellani's solution and 2 percent gentian violet in alcohol were used alternately with no improvement. Sodium perborate mouthwash had been continued three times daily. Ascorbic acid, 200 mg. daily, had been administered since the beginning of the treatment.

On 2 March penicillin mouthwash was inaugurated and used four times daily. All other drugs were discontinued at this time. On the following day the necrosis which had been present since the patient was first seen had completely disappeared. Penicillin mouthwash was continued. On 4 March the gingival tissues appeared much less hyperemic. On 5 March the use of penicillin was discontinued, because the gingival tissues appeared pink and only small hyperemic areas remained in the interdental spaces. No further treatment was given. On 10 March the patient was discharged with a healthy mouth.

CASE 2. A pilot, aged 20, came to the clinic on 20 February 1945 with Vincent's stomatitis with a considerable amount of necrosis. His mouth was cleaned with hydrogen peroxide and the necrotic areas treated with chromic acid. Sodium perborate was given to the patient to use as a mouthwash every three hours. On 22 March the condition was slightly improved, and 2 percent gentian violet in alcohol was painted on the gingivae after thorough cleaning of the teeth. This treatment was repeated on 23 March, while the sodium perborate mouthwash was continued. Little improvement was noted. On 24 March treatment was continued as before with only slight improvement. On 26 March the stomatitis had become worse, possibly because of neglect in using sodium perborate during a two-day flight. Penicillin mouthwash, four times daily, was then started, and all other treatment was stopped. On 27 March improvement of the stomatitis was noticeable, and penicillin mouthwash was continued. The patient again went on a flight, taking with him only a one-day supply of penicillin mouthwash. On 29 March all necrosis had disappeared. The gingivae looked pink, with only small patches of dark red near the interproximal spaces. Treatment was discontinued. On 31 March the gingival tissue had healed completely.

CASE 3. A patient, aged 42, with a history of Vincent's stomatitis in 1943 and marked resorption of gingival tissue, came to the clinic on 19 March 1945 with a mild recurrence. Several interproximal spaces showed necrosis, the gingival tissues were dark red, and no calculus formation was present. Penicillin mouthwash was used immediately with no other treatment. The mouth was rinsed four times daily. By the next day the condition had improved so that all necrotic areas had disappeared. Penicillin mouthwash was continued and on 21 March the gingival tissues looked pink, with only a few red spots near the interproximal spaces. All treatment was then discontinued. On 22 March the gingivae were pink and healthy.

CASE 4. A radio operator, aged 24, on flying status, reported to the clinic on 12 April 1945 with hyperemic gingivitis. All calculus was removed, the tooth surfaces polished, and a mixture of iodine crystals, zinc iodide, glycerin, and water applied to the dried gingivae. The patient went on several flights afterwards and did not return to the clinic until 18 April. At that time a diagnosis of mild Vincent's stomatitis, with necrotic areas in the interproximal spaces of upper and lower anterior teeth and dark red gingival tissues, was made. The patient was given two ounces of penicillin mouthwash and instructed to use it every four hours. No other treatment was used. He again went on a flight and used the mouthwash for one day. When he returned on 20 April, all necrosis had disappeared, and the gingival tissues looked healthy and pink. The patient was discharged as cured.

A METHOD OF FORMING TANTALUM PLATE FOR CRANIOPLASTY

MAJOR LUCIAN C. HOLTZENDORFF
Dental Corps, Army of the United States

The contouring of tantalum plate for repair of large or complicated cranial defects is best effected prior to operation. The dental service is technically best qualified for this service, as the materials and technique are related. A method of obtaining the correct shape and two methods of forming the plate to the required shape will be outlined. The patient's head is shaved, and he is placed in a dental chair with his head positioned so the area of the defect will be on a plane parallel with the floor. For operation on posterior cranial defects, it is necessary to let the arms of the chair down and have the patient straddle the chair facing the headrest. A skin pencil is used to trace on the patient's head an outline which is larger than the defect at its periphery by about ½ cm. The plate cut to this outline is made larger than the actual defect so that its margins will lap over and be supported by the edges of the adjoining cranial bone. X-rays are an aid in determining the size and marginal outline of the missing bony tissue. In addition to the routine anteroposterior and lateral plates, an x-ray taken with the plate in contact with the defect is useful. Superimposition of other cranial structures on the radiograph frequently forces the operator to rely almost exclusively on palpation as a means of locating the correct outlines of the area. Where the position of the margin of the defective area is questionable, the plate is overextended to allow an excess which may be trimmed at operation.

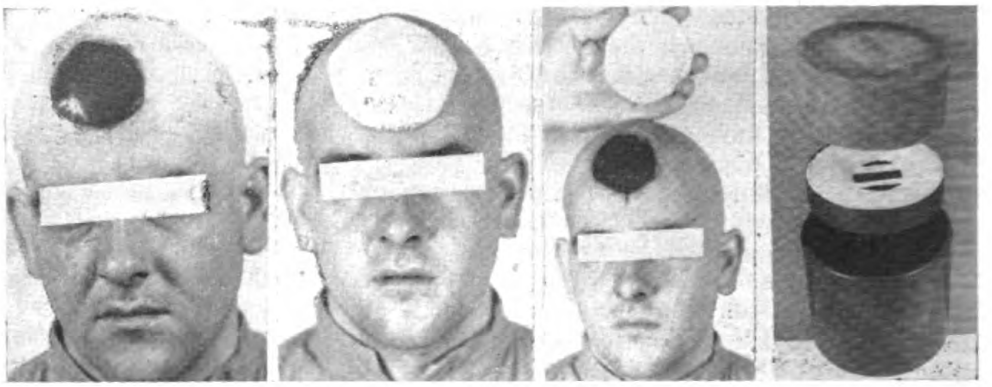
A transparent sheet of cellulose acetate (film which has been cleared by washing in hot water) is placed over the defect and held down firmly while a skin pencil is used to transfer the projected outline to the film which, when cut out, will act as a template for measuring the size of the tantalum plate. The anteroposterior axis is marked on the film and transferred to the plate so it may be correctly oriented during the swaging operation. Modeling clay that has been prepared to the consistency of a thick mix of dental stone is applied to the patient's head by gently pressing it down into the concavity. More clay is added until the area is built up and contoured to correspond with the surrounding convexity (figure 1).

If the area is not in the midline, the shape of the opposite side of the head is used as a model in forming bilateral symmetry. The head is surveyed from a distance both laterally and anteroposteriorly to assure proper form and fullness to the plastic filler. At this step it is necessary to ensure that proper contour be built into the clay filler, as the tantalum plate will itself assume the same contour.

The clay is dried and hardened on the surface by a spray of compressed air prior to an application of quick-drying varnish (clear fingernail varnish) which seals the margins of the clay to the skin and prepares the surface of clay for the next step. When the varnish has dried, a mix of dental stone containing a high proportion of powder to water is gently applied to the surface of the clay. The stone is spread out beyond the margins of the defect at least 2 cm. The necessity of placing the patient's head so the defect is at its highest point now becomes apparent as the freshly mixed stone is soft and could be displaced by gravity. The weight of the stone causes no discomfort to the patient, as the defective area is protected by the hardened clay (figure 2). The stone will make its initial set in three to four minutes and can easily be removed from a closely shaved head by first working the skin loose around the edges of the hardened stone (figure 3). The stone impression is a negative of the projected form and convexity of this area of the patient's head. When a

tantalum plate is closely adapted to the surface of this impression, it will also acquire the desired form and convexity.

There are two methods of adapting the plate to the impression. The first method involves the construction and use of a power press capable of exerting ten tons' pressure. Auxiliary equipment is constructed to contain and direct this force so that the tantalum plate will be swaged into the negative impression.



1 2 3 4

FIGURE 1. Clay adapted to defect and contoured to normal cranial curvature. FIGURE 2. Dental stone applied over clay as an impression material. FIGURE 3. Impression removed from head. FIGURE 4. Top: Rubber pressing pad. Center: Steel flask containing stone impression (tantalum plate is held in correct position by two strips of adhesive tape). Bottom: Steel cylinder which acts as a container for the flask and rubber pad.

A large mix of stone is prepared and deposited in a round steel flask. The stone impression is seated, face up, into the center of the freshly mixed stone in the flask, and the stone is smoothed out around its edges and allowed to harden for several hours. This steel flask has a flat bottom, tapered sides, and a hole in the bottom for ejecting the stone on completion of the case.

Tantalum is cut from a sheet to the size of the previously prepared film template and placed on the face of the impression in the flask correctly oriented. Two strips of adhesive tape hold the plate securely in position. The flask is placed in the bottom of a large steel cylinder. The steel cylinder is slightly larger than the flask, has a closed flat bottom, and is open at the top for reception of the power plunger.

A rubber pressing pad is placed in the cylinder over the flask. The pad is cylindrical in shape and slightly smaller in diameter than the inside dimensions of the steel cylinder. It is 4 inches thick and has a hardness of 40° durameter. Figure 4 shows steel cylinder, flask with tantalum plate, and the rubber pad in the correct relation. The cylinder is mounted under the yoke of the press and centered directly under the pressure plate. Maximum pressure is exerted through the press for two minutes. Pressure is released and the contents of the cylinder ejected.

It will be found that the pressure plate of the press has squeezed the rubber pad against the tantalum plate with sufficient force to press it down firmly against the surface of the impression underneath, thus adapting the plate to the desired form. If kinks or wrinkles are formed at the edges of the plate, they may be burnished or hammered flat against the stone impression. The patient is recalled, and the plate is fitted over the defect and corrected with pliers where and if necessary. If major corrections are indicated, it is only necessary to scrape or to build up the impression with wax and re-press the plate.

The second method of forming the plate requires less equipment. The impression is removed from the patient's head, inverted, and seated in a large freshly mixed batch of dental stone which had been deposited on a flat surface. With a spatula, the stone is pulled up to the rim of the impression. When set, the stone impression will be supported and reinforced by the large stone base.

The tantalum plate is cut out as described and placed in the impression correctly oriented. A ball pein hammer or an ordinary hammer with a rounded head is used in conjunction with sheet lead to beat down or swage the plate against the concave surface of the impression. To prevent crimping or folding of the border of the plate, it is best to start around the edges and gradually work down toward its center. The high crushing strength of the stone and its flat base will offset any possibility of fracture of the impression. The objection may be raised that lead could be impregnated on the surface of the tantalum plate with subsequent toxic effects. Tests conducted at the Chemistry Section of the Fourth Service Command Medical Laboratory do not substantiate that suspicion.

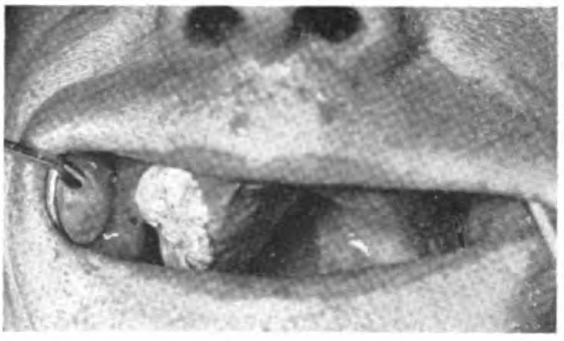
The result produced by either method is essentially the same. Hammering out the plate dents its surface, while the power press produces a much smoother prosthesis in a minimum of time. After being prepared and approved by the neurosurgeon, holes 1 mm. in diameter are drilled at intervals around the rim of the plate, and it is polished on a rag wheel loaded with pumice. A fine polish is not desired.

This semidirect method of forming the metallic implant is accurate, as its contour is shaped directly on the patient's head; it is efficient, as there is no necessity of constructing a model of the defect, a die, or a counterdie; it is economical of tantalum, as the plate is prepared to the exact size desired.

CARCINOMA UNDER DENTURE

LIEUT. COLONEL CLARE T. BUDGE
Dental Corps, United States Army

A 41-year-old soldier, with thirty-four months' active duty, was observed by the dental service at Ashford General Hospital during a routine examination. Wearing esthetically and mechanically satisfactory full upper and lower dentures, the patient gave no history of any oral or denture complaints; however, on his removal of the dentures to facilitate thorough examination of the oral cavity, a proliferating, grayish-white lesion was detected on the posterior aspect of the right maxillary alveolar process extending up and into the buccal mucosa.



Lateral jaw x-rays indicated destruction of the alveolar process of the right maxilla in its posterior half suggesting neoplastic destruction of bone. Two tissue specimens were taken for biopsy, and the pathologic report was returned with a diagnosis of "squamous cell carcinoma, grade 2."

This case clearly indicates the value and importance of a thorough routine oral examination, particularly in edentulous mouths having prosthetic replacements.

METHOD OF TESTING SENSITIVITY OF MICROORGANISMS TO PENICILLIN

FIRST LIEUT. JAMES R. COPELAND
Sanitary Corps, Army of the United States

The test for penicillin sensitivity described here compares favorably with other methods,[1 2] is simple and convenient, and requires a minimum of materials.

The penicillin-impregnated paper used in the test is prepared as follows: A fairly fine grade of filter paper is cut into small rectangles, sterilized, and dropped into tubes containing graded dilutions of penicillin. After soaking for several minutes, the paper is taken out, drained of excess liquid, placed in a sterile Petri dish, and dried in a vacuum desiccator. The penicillin filter papers of various strength are kept separate and, when dry, are ready for use or for storage in the refrigerator under sterile conditions.

The Test

The paper is laid on the surface of a plate of agar media suitable for the growth of the organism to be tested. It may be placed across the diameter of the plate or around its edge. Papers of varying strengths may be placed on the same plate when a more or less quantitative sensitivity of the organism is desired. Several organisms can be tested on the same plate with the same strength paper. The papers should be spaced sufficiently far apart to prevent the inhibitory radius of one paper overlapping the organism being tested against another paper.

Take a small loopful of a young broth culture of the organism to be tested, touch the loop to the side of the tube, and touch the agar some distance from the paper. Without flaming draw the loop from the drop at a right angle into the paper. A standard known strain is inoculated on every plate with the organism to be tested and the results interpreted in terms of it. When graded strength papers are used, the standard strain can be inoculated on one side and the organism to be tested on the other. The results are read after overnight incubation at 37° C. To give an example: Papers prepared from solutions containing 200, 20, and 2 units of penicillin per cu. ml. were set up against the standard *Staphylococcus* (Florey) and a *Staphylococcus* (No. 39) isolated from a finger wound, coagulase positive. They gave the reading shown in table I.

TABLE I

Organism	Relative strength of penicillin filter paper inhibitory activity in mm.		
	+ +	+	±
39	12	7	less than 1
Standard	14	8	3

The relative difference in sensitivity is accentuated where graded papers are used. The interpretation in this case would be that *Staphylococcus* No. 39 is more resistant than the standard. Figure 1 shows a very resistant *Staphylococcus* in comparison to the standard.

Captain Fred Heath, M.C., the laboratory staff of a general hospital, Lt. Col. J. C. Turner, M.C., and Lt. Col. R. S. Muckenfuss, M.C., assisted in this work.
The photographs were taken by a detachment of the Museum and Medical Arts Service.

1. Fleming, A.: Discussion on Chemotherapy and Wound Infection, Proc. R. Soc. M., Lond., 34:342-347, April 1941.
2. Fleming, A.: In Vitro Tests of Penicillin Potency, Lancet, 1:732-733, 20 June 1942.

Effect of Thickness of Agar on Inhibitory Activity

Others[3] have shown that the thickness of the agar is important in demonstrating penicillin activity. To illustrate this with penicillin paper, nutrient agar plates were poured and allowed to harden at an angle that permitted the agar barely to reach the edge on one side of the Petri dish from which point it graded into a thickness of 10 mm. on the other edge. Papers of equal strength placed across the diameter of the Petri dish from the thin to the thick portion of the agar were inoculated in the usual manner with *Staph. aureus* (Florey) and measured for activity the following day (figure 2). Representative results are given in table II.

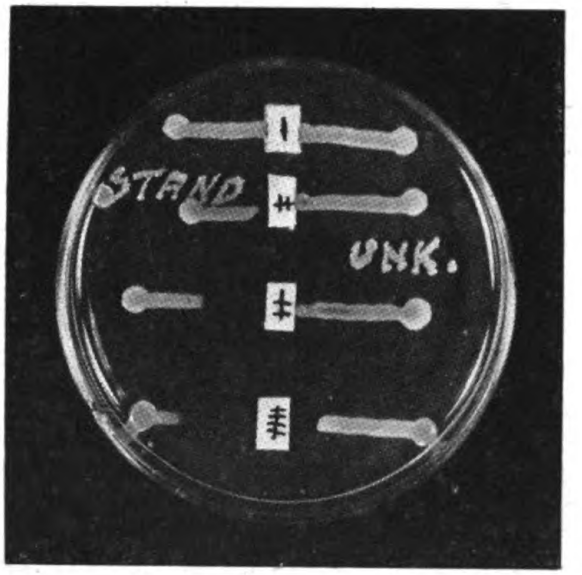


FIGURE 1. Comparison of an unknown *Staphylococcus* (right) with standard strain (left). Relative strength of penicillin paper is indicated by ++++, ++, ± and —.

The maximum inhibitory activity of the paper is therefore best demonstrated on a thin plate. Papers on blood agar plates showed less inhibitory activity than on plain agar, probably because of the fact that the blood cells impede the diffusion of the penicillin as has been brought out before.[3]

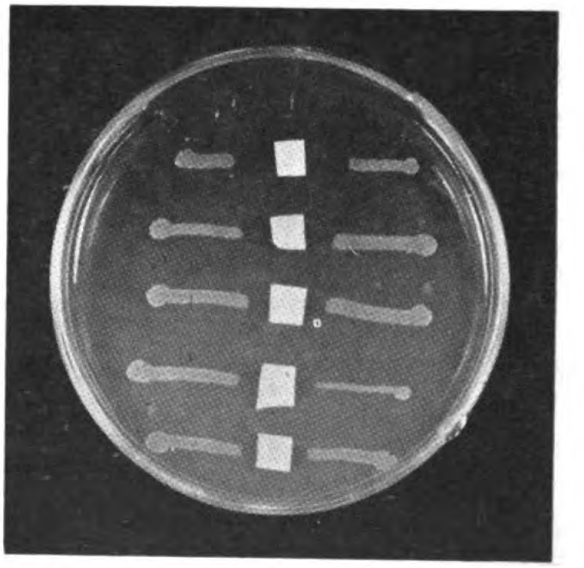


FIGURE 2. Effect of thickness of agar on inhibitory activity of penicillin paper. The top paper is at the thin portion. The bottom paper is at the thick portion.

Effect of Storage

Papers stored in the refrigerator at 4° C. were tested daily for inhibitory activity for the first thirty days and at weekly intervals thereafter (table III). Great care was taken to have uniform plates and inoculations, but variations of 1 to 2 mm. occurred. The same batch of paper on three successive days might give an inhibitory activity of 13 mm., 11 mm., and 13 mm. because of conditions

3. Abraham, E. P., Chain, E., Fletcher, C. M., Gardner, A. D., Heatley, N. G., Jennings, M. A., and Florey, H. W.: Further Observations on Penicillin, Lancet, 2:177-188, 16 Aug. 1941.

that could not be controlled. By taking an average of a number of these as done each day, one can arrive at quite accurate conclusions. While the papers appear to retain much of their activity when stored, a slight decrease occurs after storage in the refrigerator for sixty days. Papers on blood agar plates that gave inhibition 16 mm. from the edge against *Staph. aureus* (Florey) before storage, gave inhibition for 13 mm. after sixty days' storage. Papers of greater and lesser strengths give corresponding results. Incubator storage hastened the loss of activity. Papers which gave an activity of 10 mm. dropped to 6 mm. after one day of storage at 37° C. but still gave inhibition for a distance of 3 mm. after fifteen days of incubator storage.

TABLE II

Approximate thickness of agar in mm.	Activity in mm. from edge of penicillin filter paper.
1	8.5
3	6
5	4
7	3.5
9	3

Concentration of Penicillin on Filter Paper

Repeated soaking and drying of the filter paper with penicillin solution of the same strength increased its activity. This was shown in the following manner: Sterile filter papers of equal size were placed in a Petri dish and wet with the penicillin solution, then dried and, without removing from the dish, the procedure was repeated several times. After each drying a filter paper was removed. This was done fourteen times. Two series were treated in this manner with penicillin solutions of different strength, after which they were tested against *Staph. aureus* (Florey). Readings of less than 1 mm. and 3 mm. at the end of the first drying increased to 6 mm. and 11 mm. after fourteen treatments of soaking and drying. The increase appeared to be a gradual rise. It was hoped that by concentrating in this manner a method might be devised to detect small amounts of penicillin in a fluid.

TABLE III

Effect of refrigerator storage on penicillin filter paper

Paper prepared from solution containing	Before storage	1 week's storage	30 days' storage	60 days' storage.
2,000 units	19 mm.	——	17 mm.	18 mm.
200 units	16 mm.	14 mm.	13 mm.	13 mm.
20 units	11 mm.	10 mm.	8.5 mm.	*
2 units	5 mm.	4 mm.	3.5 mm.	0
0.2 units	0	0	0	—

Test organism—Staph. aureus (Florey).
*Supply exhausted.

Effect of Size and Shape

The size or shape of the filter paper apparently makes little difference in the amount of activity. Filter papers were cut into sizes varying from 5 mm. square to 20 mm. square and into thin strips of different lengths,

then impregnated with penicillin as described, and placed on agar plates previously seeded with *Staph. aureus* (Florey) (figure 3). The activity of the paper was practically the same regardless of size or shape. The diffusion of penicillin was greater from a side than at the corner. In one series, the activity from the side of the square or rectangle was 10 mm. while at the corner it was 8 mm. It is necessary to inoculate the line of streak, of the organism under test, at a right angle to the paper to get the maximum of inhibitory action.

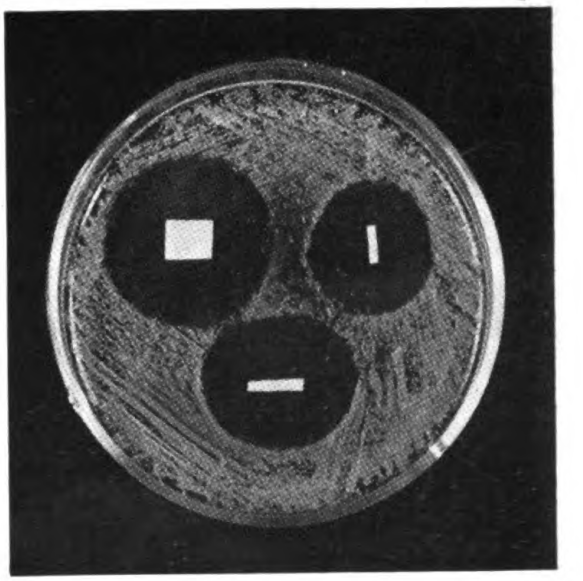


FIGURE 3. Inhibitory activity shown by penicillin papers of different size and shape. The distance from the edge of the paper through the distance of inhibition is practically the same in all instances.

Summary

Penicillin-impregnated filter paper can be used to demonstrate the relative sensitivity of a microorganism to penicillin. Penicillin sensitivity can best be shown on a thin blood or agar plate. The diffusion of penicillin is greater on plain agar. While the size or shape of the impregnated paper makes little difference, for convenience a paper 5 by 10 mm. is satisfactory. For testing, a standard known strain and the unknown should be inoculated on the same plate. The inoculation of each should be at a right angle to the side of the paper and inoculum as nearly equal as possible. By repeatedly soaking the filter paper with a penicillin solution and then drying, the inhibitory activity of the penicillin filter paper can be increased. Penicillin-impregnated filter paper loses little activity when stored in the cold at 4° C. for sixty days.

DEFLASKING TECHNIQUE

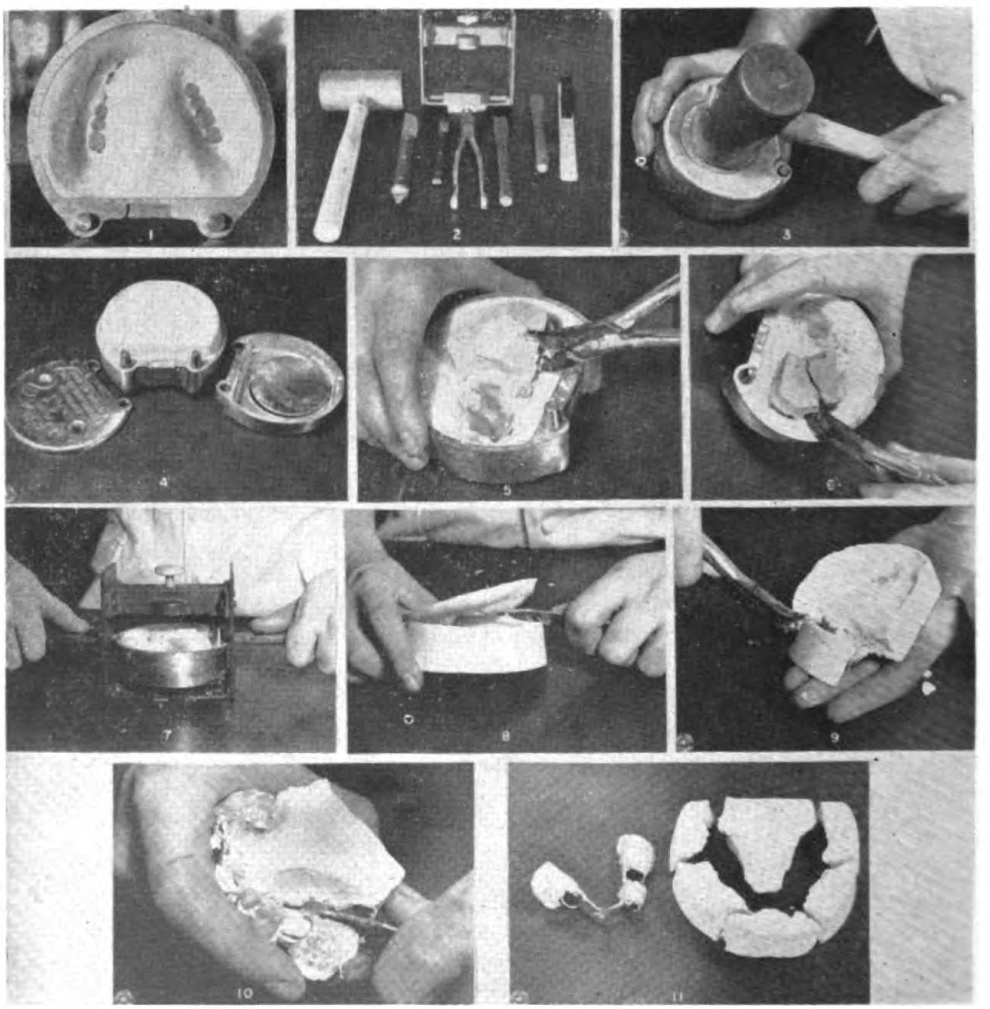
LIEUT. COLONEL M. L. MILLS
Dental Corps, United States Army
and
CAPTAIN MARKUS RING
Medical Administrative Corps, Army of the United States

Since the advent of curing acrylic in water at a temperature below 212° F., the deflasking of dentures from hard plaster or stone has presented a problem. While various types of ejector flasks have been manufactured, none of them tend to *simplify the removal of the actual denture from the surrounding plaster or stone.* At the Central Dental Laboratory, deflasking became a major problem with a 9.7 percent breakage of 300 dentures daily. Many suggestions and variations were applied concerning technique,

Credit for developing this technique belongs to the entire personnel of the Central Dental Laboratory, Fort McPherson, Georgia.

materials, packing, and deflasking, and from them was evolved a simplified technique which has reduced breakages of dentures during deflasking to 1.6 percent. The number of technicians required to deflask the same number of dentures was decreased by 50 percent.

Waxing is done in the usual manner and the model trimmed to fit the flask. All gold framework is held on the model, and abutment teeth are not cut down or removed to free the clasp arms. The flask is lubricated with petrolatum, and the model is invested in the lower half, separator applied, and the upper half poured, leaving the occlusal surfaces of porcelain teeth and occlusal or incisal rests exposed (figure 1). Separator is applied, and



the flask filled with artificial stone, the lid placed on and allowed to set. The case is then carried through to the deflasking stage. The instruments used (figure 2) are mallet (Med. Dept. Item No. 3350000); knife, plaster (Item No. 5373000); knife, office (Item No. 5372000); forceps, tooth-extracting, No. 151A (Item No. 5325000); ejector with pry-bars (Item No. 5310600), and any suitable brush. The forceps must be annealed, hammered, ground to give two concave cutting blades which do not contact on closure, and then retempered. Ordnance or engineer facilities, where available, should be used for alteration of the forceps.

Deflasking is begun with the removal of the lid and lower half. The

ejector may be used in removing the bottom section; however, much time is saved by merely tapping the disk (figure 3) with the mallet. This procedure does not injure the flask or denture. Figure 4 shows the denture and investment securely held in the middle ring while the plaster in the bottom half and model is clipped away with the forceps (figures 5 and 6). The *entire and complete model should be removed in sections* before proceeding. At this point, the middle section is placed in the ejector (figure 7), and the ring removed by upward pressure on the pry-bars. A knife blade inserted at the junction of the stone and plaster (figure 8) removes the stone core, thus exposing the teeth and rests. Complete deflasking as shown in figures 9 and 10. Figure 11 shows the deflasked denture, the surrounding plaster, and where the forceps were used to split the plaster into six pieces. The large center section should be freed from bar, clasps, and any undercuts before attempting to lift it out. Note where this section has been trimmed with a knife along the lingual-occlusal border of the denture.

It was found that by holding the framework without removing any part of the stone abutment teeth, the danger of bending clasps was eliminated in that the surrounding plaster does not grip the clasp and will break away easily. By clipping out the stone model while the denture is still embedded in plaster (figures 5 and 6), breakage of buccal flanges with severe undercuts can be virtually eliminated.

COMBINATION OF GIEMSA'S AND FIELD'S STAINS FOR MALARIA PARASITES

CAPTAIN JOHN Y. C. WATT
Sanitary Corps, Army of the United States
and
TECHNICIAN THIRD GRADE CLYDE C. BLACKBURN
Medical Department, Army of the United States

It is often difficult to diagnose parasites in the blood of persons receiving suppressive therapy; either very few parasites are present or they present an atypical morphology.[1] In routine examinations of smears of blood donors and hospital patients, we often have difficulty in distinguishing early ring forms of *Plasmodium vivax*—such as, single ring with two chromatin dots, or two or more ring forms in a single red blood cell, from those of *P. falciparum*. This was also true in double or mixed infections with one or more species of plasmodium parasites.[2] We tried modifying various standard staining techniques, but none gave the results desired. Field's[3] technique, if handled expertly, gives excellent results, but it is good only for freshly prepared thick smears.

A method, Giemsa and Field combination, was devised which has been very successful in making laboratory diagnosis in both thick and thin smears in an Army medical general laboratory.

Thick smear. A drop of blood, the size of a small pea, is placed in the center of a slide. Using the corner of another slide as a spreader, the drop is rotated and spread to the size of a five-cent piece. The circular spreading motion facilitates an evenly mixed and defibrinated thick smear.

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1. Denhoff, E. and Piper, B.: Laboratory Aids in the Diagnosis of Malaria, J. Lab. Clin. M., 29:518-524, May 1944.
2. Tommaso, T.: Di un case di terzana mista con due parassiti di plasmodium vivax in una stessa amazia, Boll. Soc. ital. Med. Igiene Trop. (Sez. Eritrea), Asmara, 2:7-11, 1943.
3. Field, J. W.: a. Morphology of Malarial Parasites in Thick Blood Films, Tr. R. Soc. Trop. M. Hyg., Lond., 34:405-414, May 1941.
b. Further Notes on Method of Staining Parasites in Thick Blood Films, Tr. R. Soc. Trop. M. Hyg., Lond., 35:35-42, July 1941.

Thin smear. With the edge of a slide, a small drop of blood is spread evenly over the slide. Both thick and thin smears may be made on the same slide, if desired. The smears are then air-dried but not necessarily stained immediately.

Thick smears are dehemoglobinized for ten to fifteen minutes in distilled water before being stained. Care should be taken that the thick smears are not unnecessarily agitated during the entire process of dehemoglobinization and staining. Thin smears are fixed with absolute methyl alcohol in a Coplin jar for three minutes.

Staining Procedure

(1) Immerse the film in Field's solution "A"* for ten seconds. (2) Immerse in distilled water for ten seconds. (3) Immerse in Field's solution "B"† for ten seconds. (4) Immerse in distilled water for ten seconds. (5) Immerse again in solution "A" for ten seconds. (6) Immerse in distilled water for ten seconds. (7) Immerse in Giemsa's solution‡ diluted 1:20 with 6.8 buffer solution§ for twenty minutes. (8) Rinse with distilled water. (9) Air-dry and examine.

Results

Malaria parasites can easily be identified in the thick smear since the normal red blood cells are destroyed leaving only the partially dehemoglobinized red blood cells infected with parasites free and concentrated on a clear background. Schüffner's dots, chromatin materials, cytoplasm as well as pigments of the parasites are distinctly shown. The polymorphonuclear leukocytes and monocytes stain violet-blue. In thin smears the parasites with typical bright red to crimson chromatin associated with blue cytoplasm are present. Schüffner's dots are always shown even in the very early stage of development of *Plasmodium vivax*. *P. falciparum*, particularly in early trophozoite forms, which are often indistinguishable from those of *P. vivax* or *P. malariae*, can be identified by the presence of a distinct golden-brown clumped pigment associated with deep red chromatin and heavy blue cytoplasm, but without stippling in the red blood cells.

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*Field's solution "A":

Methylene blue	0.8 gm.
Azure B	0.5
Disodium phosphate (anhydrous)	5.0
Potassium phosphate, monobasic (anhydrous)	6.25
Distilled water	500 cc.

Note: In the event azure B is not available, it is possible to prepare a methylene blue and azure mixture of undefined composition from the medicinal methylene blue. Solution "A" may be prepared as follows:

1. Dissolve 1.3 gm. of medicinal methylene blue and 5.0 gm. of anhydrous disodium phosphate in 50 cc. of distilled water.
2. Bring to a boil and then evaporate in a water bath almost to dryness.
3. Add 6.25 gm. of anhydrous potassium phosphate, monobasic.
4. Add 500 cc. of distilled water, stir till the stain is completely dissolved, and set aside for twenty-four hours.
5. Filter before use.

†Field's solution "B":
Dissolve 5 gm. of sodium phosphate dibasic in 500 cc. of distilled water. Add 6.25 gm. of potassium phosphate. Add 1 gm. of eosin Y.

‡Giemsa's stock solution:

Giemsa powder	0.5 gm.
Glycerin (dissolve powder in glycerin 1 to 2 hours)	33.0 cc.
Methyl alcohol, absolute (acetone-free)	33.0 cc.

§Buffer solution, pH 6.8:
M/15 stock solutions of Na_2HPO_4 and KH_2PO_4 are added to distilled water in approximately the following proportions.

Na_2HPO_4	35 cc.
KH_2PO_4	65 cc.
Distilled water	900 cc.

The buffer solution is tested with bromthymol blue indicator standards and adjustments made if necessary.

INSPECTION OF DRIED WHOLE EGGS

CAPTAIN ROBERT W. MENGES
Veterinary Corps, Army of the United States

The Quartermaster Corps began a program early in 1944 to build up a backlog of frozen eggs during the season when shell eggs were plentiful and best in quality. During the same season liquid eggs were to be dried. In the summer when the quality of the shell eggs became very poor, then the frozen eggs were to be dried instead of the liquid eggs. Standards were set up by the Subsistence Research and Development Laboratory of the Quartermaster Corps, which the veterinary inspectors followed in their inspection work. As a result of this program numerous improvements were made in the final product.

The standard procedure in an egg-breaking plant begins with the candling of the eggs to remove rots and bloody eggs. After candling, the eggs are broken, inspected, mixed, strained, and finally cooled. The cooled liquid eggs may be shipped to a canning plant where they are canned and frozen, or they may go direct to the drying plant. The drying plant is usually equipped to receive and hold liquid eggs at temperatures below 45° F. The arrangement of equipment in a drying plant will vary with the type of drier used. When canned frozen eggs are dried, a special setup of equipment is necessary. The extra equipment is needed for thawing and heating the frozen eggs. The various plant arrangements, the types of equipment, and the procedures followed should be familiar to the veterinary inspector.

Liquid eggs shipped to the drying plant were dried immediately and therefore rejection was impossible. The liquid eggs from breaking plants were mixed together, which also complicated matters. However, when high bacterial counts were obtained in liquid egg shipments, a complete check-up was made of the sanitation in each breaking plant. The sanitation of the tank trucks and methods of disinfection were also checked.

One of the most important phases of the inspection of powdered eggs is checking the sanitation in the breaking plant. From experience gained in the breaking plants the following procedures should be checked carefully:

1. Pails and breaking equipment should be washed and chlorinated just before using. Equipment should be chlorinated in the morning even though it is washed the night before. Allow the equipment to stand in the chlorine solution one minute or more.

2. Wash and chlorinate pails and breaking equipment at each rest period if possible.

3. Strainer tank, weigh tank, pouring tank, and pipe lines should be washed and chlorinated at each rest period if possible. They definitely should be washed at noon.

4. The women breaking eggs should have clean, dry hands at all times.

5. Slightly dirty eggs should be broken with the dirt specks up and the clean side down.

6. When washing metal equipment it is necessary to have on hand some steel wool, so that hardened substances can be removed.

7. The chlorine solution rinse water should be 100 parts per million, and changed when the strength drops to 50 parts per million.

The most common chlorine preparation used is "B-K" powder, which can be used in hot or cold water. To obtain 100 parts per million use one-half level teaspoon per 2 gallons of water; 200 parts per million, one level teaspoon per 2 gallons of water. Two systems or methods of use are recommended. One is the flow system. The solution of B-K flows from one piece of equipment to another through the piping and vats. A dilution

of 100 parts per million is used for this system. The second method is the spray system. A compression sprayer is used to spray all parts of equipment. A dilution of 200 parts per million is used for this system. Be sure the equipment is not rinsed with water after chlorinating.

Since it is necessary for the inspector to know the chlorine content of the rinse water, he must have in mind a method of determining the chlorine content. One of the most common tests for free chlorine is the ortho-tolidine test. Another chlorine test was used commonly by the F.S.C.C. inspectors in the breaking plants. It is called the "B-K chlorine test," obtained from the General Laboratories, Division of Pennsylvania Salt Manufacturing Company, Philadelphia, Pennsylvania.

The available chlorine in the rinse water is important in disinfecting equipment, and also following the process of washing dirty eggs. B K is commonly used as a rinse for washed eggs. The disposal of dirty eggs is a problem which confronts all inspectors in egg-breaking plants. One of our plants had an egg-washing machine which did not do a good job of washing; so to solve the dirty egg problem the manager found a market for his dirty eggs and discontinued breaking them for the Army. The other egg-breaking plant had women washing eggs by hand. After washing, the eggs were soaked in B-K solution and dried. Toward the end of the breaking season this plant tried a new germicide, but since the product was used only a short period of time, the actual value cannot be given. Washed eggs may easily be a source of high bacterial counts. If eggs are to be washed, strict sanitary measures should be adopted. The eggs should not be soaked for long periods before washing, and the washed and dried shell eggs should be broken immediately. The practice of washing and chlorinating eggs at night and breaking in the morning should not be followed. Another bad feature about washing dirty eggs is the rise in temperature which occurs, especially if warm water is used.

The egg temperatures are important in connection with the bacterial count. According to Technical Bulletin No. 2,[1] the shell eggs should be stored under conditions which produce liquid egg, having a temperature not to exceed 45° F. at the time of breaking. The temperature was taken at four points to check for compliance with this regulation. The temperature of the shell eggs was checked, and then the temperature of the liquid egg in the buckets, in the pouring tank, and after cooling. In one breaking plant the shell eggs were held in a cold-storage room at 50° F. or below. The temperature of the liquid egg in the buckets varied from 40° to 58° F. In the pouring tank the temperature increased to 46° to 59° F. After cooling, the temperature dropped to 36° to 42° F. In the other breaking plant the temperatures varied a great deal. The cold-storage room was not large enough to accommodate all the eggs to be broken; therefore, some of the shell eggs were held in warm storage at room temperature and some in the cold-storage room. In the warm-storage room the shell eggs varied from 55° to 70° F. The eggs in the cold-storage room ranged from 36° to 44° F. at the time of breaking. The bucket temperatures varied from 40° to 70° F., and the pouring tank temperatures were 52° to 70° F. After cooling, the temperature dropped to 36° to 43° F. The temperature of each tank truck of liquid eggs was checked at origin and destination. If the temperature went above 45° F., the tank of liquid eggs was rejected. It was found that, if the tank truck was well insulated, the temperature would rise only one or two degrees during shipment.

1. Published 18 January 1944 by the Chicago Quartermaster Depot, Subsistence Research and Development Laboratory, on "Operating Standards for Egg Storage, Breaking, Freezing, and Drying Plants."

As soon as the temperature of a tank truck of liquid eggs was taken at destination, then a sample was obtained for bacteriologic examination. At the drying plant a sample was taken for each tank truck, using a small cup with a long handle. The cup was kept clean and held in a jar containing chlorine solution when not in use. The liquid egg was poured into a sterile glass bottle which was immediately taken to the laboratory where it was kept under refrigeration until the next morning when the liquid was plated. At the canning plants the sample was obtained at the fill-valve where the liquid eggs were being canned. A sterile bottle or can was used, which was flamed after opening and before closing. These samples were frozen immediately and taken to the drying plant as soon as possible, usually within two to three days. The samples were packed in chopped ice for shipment. A lot consisted of about 450 cans, or one tank truck load. One sample was taken for each lot. In most cases an attempt was made to obtain a composite sample. If a lot did not comply with specifications, then in a few instances additional samples were taken of the frozen product. To determine the number of cans of frozen eggs to sample for a certain lot, the square root of the total number of cans was taken. The number of cans sampled should not be less than five or more than twenty-five. A long auger and a teaspoon were used to obtain the sample. The auger and teaspoon were sterilized by sponging with alcohol-soaked cotton and igniting the alcohol. This process was repeated a second time. One drilling was made diagonally through the egg so that the shavings represented egg from the center as well as the edges of the block. Two teaspoonfuls of the egg borings were then transferred with aseptic precautions to a sterile jar. The shavings from each can to be checked were added to the jar for each particular lot, one sterile jar being used for each lot. After obtaining a sample it was placed in a freezer. These samples were finally taken to the drying plant for analysis.

Another technique of sampling was necessary for dried whole eggs. The sample was collected at the filler from the filled cans before they were sealed. A tablespoon was flamed and used to obtain the sample; then the sample was placed in a sterile No. 10 can fixed with a cone-shaped opening which was closed with a clean stopper. A composite sample was obtained by collecting powder several times during the day's run; the sample was divided into three parts, one part being sent to the company laboratory, and two parts to the service command laboratory. Two identical samples were sent in case one sample was broken or damaged. The samples were placed in small tins supplied by the service command laboratory and then placed in regular 3-pound egg cans, sealed, and run through the gas process. This was done to prevent any possible absorption of moisture while in transit.

The sampling techniques must be carried out properly to obtain accurate results. Aseptic procedures should be followed because the liquid, frozen, and dried whole eggs are accepted or rejected depending on the bacteriologic results. According to C.Q.D. No. 169,[2] liquid and frozen whole eggs were accepted, provided the standard plate count did not exceed 500,000 per gram, coliform count 1,000 per gram, and the yeast and mold count 100 per gram. Several breaking plants had difficulty in meeting the coliform standard, so it was increased to 10,000 per gram.

The frozen egg backlog program was to be discontinued 15 July 1944; however, the program started late and the Army was short of the frozen eggs necessary for the fall and winter egg drying and for the canned meat program; therefore, the program was continued an additional month.

2. Quartermaster Corps Tentative Specification C.Q.D. No. 169, dated 31 January 1944, on "Egg and Egg Products: Frozen."

Since the elevated temperatures and humidities during the summer were causing a sharp increase in the bacterial counts of the liquid eggs, the requirements were changed. The service command veterinarians were authorized to accept or reject lots of frozen eggs depending on the laboratory findings, the sanitary condition of the operations and plant, the previous performance record, and the views or recommendations of the plant inspector. In addition, the dried whole eggs had to comply with definite requirements. The standard plate count could not exceed 50,000 per gram as a general operating standard. Standard plate counts between 50,000 per gram and 100,000 per gram were acceptable only if such counts constituted a relatively small percentage of the total samples. The powder with standard plate counts exceeding 200,000 per gram was rejected. The coliform count was not to exceed 1,000 per gram. These standards went into effect on 15 July 1944.

The bacteriology of the shell egg is very important. If handled properly, infertile shell eggs are usually sterile. In the presence of filth and moisture, bacteria find their way into the interior of the egg through the shell. This explains the objection to dirty and washed eggs. Coliform organisms are normally present on the eggshell. Inedible eggs, such as rots, green whites, digested whites, and musty eggs, are heavily infected with bacteria. If these are broken with good eggs, the bacterial counts will be increased considerably. To determine whether the grade had anything to do with the bacterial counts in eggs, a dozen eggs of each grade (A, B, and C) were broken separately, and each dozen mixed in a sterile container. Aseptic procedure was used, and the samples were taken to the laboratory and plated. The grade A (extra) eggs had a standard plate count of ten thousand, and a yeast and mold count of zero. The grade B (standard) eggs had a standard plate count of twenty thousand, and a yeast and mold count of zero. The grade C (trade) eggs had a standard plate count of three million and a yeast and mold count of ten. These results indicate that low-grade eggs have high bacterial counts. Several "farm-washed eggs" were plated. The coliform count was zero, the standard plate count, too many to count, and yeast and mold count, ten. Farm-washed eggs are not desirable because they usually have high bacterial

TABLE I

Average bacterial and yeast and mold counts for liquid whole eggs during the period 15 March to 29 July 1944

Date (week ending)	Standard plate (count in thousands)	No. plates	Coliform counts	No. plates	Yeast and mold counts	No. plates
1 April	80	27	494	28	7.0	29
8April	56	20	1,372	24	0.8	24
15 April	242	49	1,848	50	0.4	50
22 April	106	78	1,175	68	0.7	68
29 April	120	77	1,704	51	0.6	51
6 May	271	75	1,962	39	0.6	33
13 May	408	64	1,807	43	0.9	35
20 May	322	80	1,936	40	0	40
27 May	294	74	2,936	37	0.3	37
3 June	379	59	2,345	31	3.5	31
10 June	598	72	2,866	36	15.0	36
17 June	1,025	67	8,391	35	10.0	35
24 June	769	74	13,500	37	11.0	37
1 July	1,809	66	12,634	32	15.4	33
8 July	1,428	43	11,690	22	10.4	22
15 July	1,299	62	10,251	31	12.5	31
22 July	2,529	57	12,944	29	15	29
29 July	1,421	48	7,125	24	8	23

Total weeks—18
Total plates counted (standard plate)—1,092
Total plates counted (coliform)—657
Total plates counted (yeast and mold)—644
Total plates counted—2,393

counts. It would be difficult to stop the farmer from washing his eggs. In some cases the breaking plants offer a slight premium for clean eggs. This increases the number of farm-washed eggs because the farmer is interested in price and does not worry about the bacterial counts.

TABLE II

Standard plate counts of the liquid egg as it is processed—samples taken at breaking plant

Source of sample	Standard plate count
From cup—Table I	2,000
From cup—Table II	3,000
From cup—Table III	0
From cup—Table IV	1,000
From cup—Table V	1,000
Pail to dump tank	486,000
Pail to dump tank	2,000,000
From the dump tank	37,000
From the churn	314,000
From the strainer	398,000
From the trough under the cooler	425,000
Pipe out of the storage tank	485,000
Sterilizing water	0
Cracked dirty shell egg	510,000
Badly cracked dirty shell egg	2,000
Washed uncracked egg	0

Each liquid or frozen egg sample was plated on the media set forth in the specifications, to determine the standard plate count, coliform count, and the yeast and mold count. Duplicate plates were prepared for the standard plate count with a dilution of 1/10,000. The plates were incubated seventy-two hours at 32° C. A single plate was prepared for the coliform count with a dilution of 1/100 for each sample. The plate was incubated twenty to twenty-four hours at 37° C. A single plate was also prepared for the yeast and mold count with a dilution of 1/10 for each sample. The plate was incubated seventy-two hours at 32° C. The results obtained after plating were recorded on Liquid Egg Form No. 1, and the results were totaled at the end of each week, a weekly average being determined. The weekly averages for the period 15 March to 29 July 1944 are indicated in table I. The bacterial counts and the yeast and mold counts began to increase early in June, and after 10 June the standard plate counts remained above the maximum of 500,000 per gram. The coliform counts increased above the 10,000 per gram maximum on 24 June and remained above until 29 July. The yeast and mold counts did not exceed the maximum of 100 per gram. These observations give some indication as to the seasonal effect on the liquid egg counts.

TABLE III

Standard plate counts of the liquid egg as it is processed—samples taken at breaking plant

Time	Source of sample	Standard plate count
1 p.m.	Egg off the breaking knife	2,000
	Pail to the dump tank	1,000
	Out of the dump tank	76,000
	Into churn	181,000
	Out of churn into strainer	529,000
	Sterilizing water	0
5 p.m.	Eggs off breaking knife, table I	26,000
	Eggs off breaking knife, table II	10,000
	Eggs off breaking knife, table III	89,000
	Eggs off breaking knife, table V	10,000
	Pail to dump tank	56,000
	Egg from dump tank	210,000
	Into the churn	143,000
	Into the strainer	190,000
	From trough under one end of cooler	823,000
	From trough under other end of cooler	900,000
	Into storage tank from cooler	789,000
	Out of tank truck	940,000
	Sterilizing water	0

When the bacterial counts increased above the maximum outlined in the specifications, steps were taken to correct the high counts. The tank trucks were checked to see they were properly cleaned and chlorinated before filling; also, the piping and pumps used to pump the liquid eggs into the plant should be cleaned after each load and put on a rack. If the trouble was in the breaking plant, it was not so simple to detect. The best method of checking a breaking plant is as indicated in tables II and III. Liquid egg samples should be taken at every process—breaking cup, dump tank, churn, strainer, etc.—then plated and the standard plate counts

obtained. Usually, by placing these in the order of processing, some evidence of where the trouble lies can be detected. In table II the standard plate counts of the liquid egg samples from the breaking cups were very low. However, after the liquid egg was poured into the pail, then to the dump tank, the standard plate counts increased almost to the maximum of 500,000 per gram. This would indicate contamination from the equipment and a need for a general cleanup. In table III, the standard plate counts are below the maximum until the liquid egg reached the cooler (surface type). After passing over the cooler the counts of the liquid egg increased above the maximum and remained high to the tank truck. Therefore, the plate counts indicate that the cooler would be the source of the trouble. In this manner a defect in the sanitation of the breaking plant can be located.

Toward the end of the breaking period the standard plate counts and the coliform counts became exceedingly high. At this time the drying plant began heating the liquid egg before drying. The liquid egg was heated to 138° F. in a plate-type Cherry-Burrell heater, and then cooled immediately in an internal-tubular cooler. To get an idea of the effect of this procedure on the coliform and standard plate counts, three lots of eggs were sampled. Samples were taken of the liquid before and after heating; also, samples of the powder from these lots were plated. The average standard plate count of the liquid egg before heating was 1,533,333, and the average coliform count was 17,723. After heating, the standard plate count dropped to 25,333, and the coliform count dropped to 1,690. The percentage decrease was about 98 percent for the standard plate counts, and 90 percent for the coliform counts. The standard plate count average for the powdered whole eggs was 12,000, and the coliform count, zero. Therefore, the drying process also decreases the standard plate count and eliminates the coliform count. At least, such was the indication from these results.

The 15th of July was the starting date to begin drying the canned frozen whole eggs, most of which were in cold-storage plants and had to be shipped to the drying plant. To keep a record of the lots of frozen eggs received, and also to determine the effect of storage on bacterial counts, Liquid Egg Form No. 2 was developed. Each lot of frozen eggs had been checked as it went into storage, and when these lots came out of storage an additional sample was taken. The bacterial and yeast and mold counts were averaged together under two storage time periods. Table IV indicates the average counts of the frozen eggs after being in storage 28 to 80 days. Table V indicates the average counts of the frozen eggs after being in storage 92 to 180 days. In all but the coliform average in table V, the counts increased during storage.

TABLE IV

Frozen egg record

(Time in storage—28 to 80 days)

A. Standard plate count average	
1. Liquid egg before storage (No. plates counted—14)	1,430,000
2. Frozen egg after storage (No. plates counted—14)	1,812,000
Difference	382,000
Percent difference	21%
Standard plate count increased	21%
B. Coliform count average	
1. Liquid egg before storage (No. plates counted—7)	9,500
2. Frozen egg after storage (No. plates counted—7)	14,757
Difference	5,257
Percent difference	36%
Coliform count increased	36%
C. Yeast and mold count average	
1. Liquid egg before storage (No. plates counted—7)	12.8
2. Frozen egg after storage (No. plates counted—7)	21.4
Difference	8.6
Percent difference	40%
Yeast and mold count increased	40%

After the frozen eggs had been sampled they were crushed, thawed, heated, and dried. Liquid eggs were much easier to handle and could be dried without further processing. The final product, the

dried whole eggs, was sampled and most of the laboratory work was done at the service command laboratory. From 7 July to 5 August the coliform average was zero, and the standard plate count average was 70,740 (29 plates counted). Some of the dried egg bacterial counts were above the maximum, but the counts did not run high regularly. The powder temperature taken at the time of canning varied from 86° F. to 128° F. The palatability score of the powder, which was to be not less than 7.5 according to C.Q.D. No. 117A,[3] varied from 6.5 to 9.0. The fluorescence varied from 13.0 to 28.7. Thirty is the limit for fluorescence according to the specification. The moisture content of the powder varied from 0.3 percent to 2.60 percent, the limit being 2 percent. The powder was put in the cans by means of a vacuum filler. The cans were sealed and a hole was punched in the top of the lid. After this process, the cans went into a gas chamber which contained a mixture of 35 percent carbon dioxide and 65 percent nitrogen. As the cans came out of the gas chamber, the holes in the lids of the cans were filled with solder.

TABLE V

Frozen egg record

(Time in storage—92 to 180 days)

A. Standard plate count average	
1. Liquid egg before storage (No. plates counted—79)	79,000
2. Frozen egg after storage (No. plates counted—75)	92,000
Difference	13,000
Percent difference	14%
Standard plate count increased	14%
B. Coliform count average	
1. Liquid egg before storage (No. plates counted—65)	1,472
2. Frozen egg after storage (No. plates counted—41)	1,119
Difference	353
Percent difference	24%
Coliform count decreased	24%
C. Yeast and mold count average	
1. Liquid egg before storage (No. plates counted—65)	1.6
2. Frozen egg after storage (No. plates counted—39)	4.6
Difference	3
Percent difference	65%
Yeast and mold count increased	65%

Shortly after the cans were completely processed, a sample was taken for oxygen analysis. Usually three cans were checked during the day's run. The equipment used was essentially a modification of the Orsat apparatus, working on the same principle but designed only for the measurement of oxygen. The sealed can has a certain amount of head space filled with a mixture of nitrogen, oxygen, and carbon dioxide. By puncturing the test can in both ends and introducing carbon dioxide in one end, the mixture of gases can be swept out of the can. If it is then bubbled through potassium hydroxide, the carbon dioxide is removed, and the oxygen-nitrogen mixture can be collected and its volume measured. Rather than attempt to get all of the gas that is in the sample can, an arbitrary volume of the mixture is usually collected. After measuring, the mixture can be brought in contact with a caustic solution of pyrogallol to absorb the oxygen. If the residual nitrogen is then measured, the volume of oxygen can be found by subtraction and its percentage in the original mixture can be calculated. The pyrogallol solution can be tested; if the pyrogallol is exhausted, inaccurate results will be obtained.

The canned, dried, whole eggs, the finished product, were packed, six 3-pound cans to the case. Two recipe books placed in each case told how to reconstitute the powdered eggs and how to use them for the daily menu. The cases were strapped and sent to a storage room kept at 50° F. or below where the product was held until shipment.

3. Quartermaster Corps Tentative Specification C.Q.D. No. 117A, dated 28 January 1944, on "Eggs, Dried."

RAPID METHOD FOR DETERMINATION OF BLOOD SULFONAMIDES

CAPTAIN ABRAHAM SAIFER
Sanitary Corps, Army of the United States

Widespread use of the sulfonamides is still being made in the field in meningococcic infection, bacillary dysentery, gonorrhea, and in the treatment of war wounds at the more forward installations. This therapy is usually given with little or no laboratory control. The Bratton and Marshall[1] sulfonamide method, which is currently recommended, requires too many reagents, some of which are difficult to obtain and require too much equipment for routine use in the field. To overcome these difficulties a number of authors have proposed modifications of the Werner[2] method using dimethylamidobenzaldehyde. The method presented in this paper is rapid, sufficiently accurate for field purposes, requires no expensive apparatus, and eliminates the errors due to the presence of proteins and normal amounts of urea.

Principle of the Method

P-dimethylamidobenzaldehyde in alcohol-ether solution (3:1) reacts with sulfonamides to give a yellow color in acid solution. This reagent also gives yellow or interfering colors with urea or protein in acid solution. The proteins are precipitated and the sulfonamides simultaneously extracted from whole blood, serum, or plasma by shaking with a *neutral* solution of p-dimethylamidobenzaldehyde in alcohol-ether. The centrifuged extract is transferred to another tube, made acid with N hydrochloric acid, and the yellow color is compared against a set of standards prepared from whole blood containing known amounts of the sulfonamide.

Reagents

1. P-dimethylamidobenzaldehyde (Med. Dept. Item No. 1325700). This product should be reagent grade. The product usually supplied by the Army is impure and should be twice recrystallized by dissolving the substance in the minimum volume of warm 95 percent alcohol and then adding about an equal volume of water. Allow to stand in a cool place or an icebox until the product crystallizes out. It is sometimes necessary to scratch the vessel or seed the solution to cause crystallization to begin.

2. Alcohol-ether (3:1). Mix 3 volumes of 95 percent alcohol with 1 volume of U.S.P. ethyl ether.

3. Sulfonamide reagent: 0.5 percent dimethylamidobenzaldehyde in alcohol-ether (3:1).

4. Hydrochloric acid—1N.

Preparation of Standard Sulfonamide Solutions

Since sulfadiazine was the most commonly used sulfonamide in this theater, it was used in the preparation of the set of standards in the following manner:

Exactly 15 mg. of chemically pure sulfadiazine were weighed on an analytical balance and dissolved in about 90 ml. of whole blood (obtained from outdated blood-bank blood) in a 100-ml. volumetric flask by

1. Bratton, A. C., and Marshall, E. K., Jr.: New Coupling Component for Sulfanilamide Determination, J. Biol. Chem., 128:537-550, May 1939.
2. Werner, A. E. A.: Estimation of Sulphanilamide in Biological Fluid, Lancet, Lond., 1:18-20, 7 Jan. 1939.

thorough mixing. The mixture was then diluted to mark with the blood and again mixed. The blood sulfadiazine solution, corresponding to 15 mg. percent, was then diluted with the original whole blood to sulfadiazine levels of 12, 8, 5, 3, and 1 mg. percent. The sulfadiazine levels of all the prepared samples were then checked for accuracy by the Bratton and Marshall procedure. The remaining procedure for the preparation of the whole blood sulfadiazine standards is exactly as given below for the unknown, except that pipettes were used to make more accurate measurements instead of using the graduations of the centrifuge tube.

Field Test Kit

A kit (figure 1) prepared for the determination of the sulfonamides contained the following items:

One dropping bottle, 30 or 60 ml. (Med. Dept. Item No. 4048000), containing N hydrochloric acid. Six test tubes, Loeffler, 120 by 13 mm. (Item No. 4437000) containing the standards. Tubes should be selected for uniform diameter. These standards were tightly corked with No. 2 cork stoppers, wrapped with waterproof adhesive tape, and the upper portion of the tube dipped into melted paraffin to provide an airtight seal. The standard tubes were then labeled according to their sulfadiazine concentration. No change was observed in these standards as compared to fresh standards after four months' standing under room conditions.

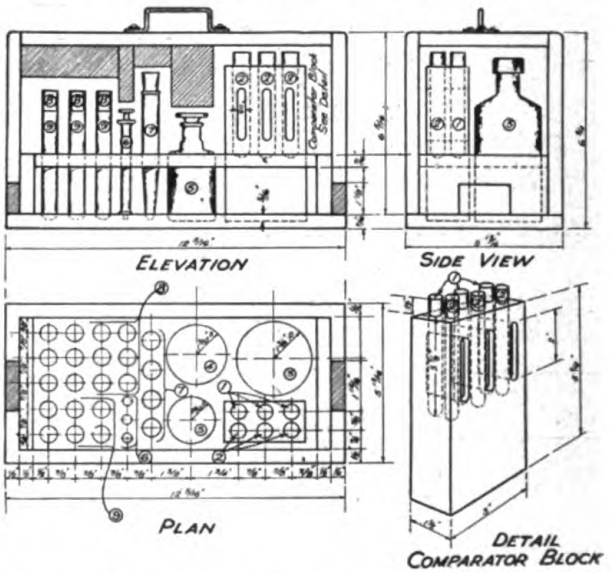

FIGURE 1. Kit for the determination of sulfonamides in field medical installations:

(1) Loeffler tubes containing water blanks.
(2) Loeffler tubes containing standards.
(3) Bottle with sulfonamide reagent.
(4) Bottle with alcohol sponges.
(5) Dropping bottle with N hydrochloric acid.
(6) 1-ml. graduated Luer syringe.
(7) 15-ml. graduated centrifuge tubes with rubber stoppers.
(8) Loeffler tubes containing additional standards and empty tubes for unknowns.
(9) Wassermann tubes containing sterile needles.

Nine test tubes, Loeffler, as above, for use in comparing unknowns against the set of standards and for water blanks in the comparator block. Four centrifuge tubes, 15 ml., graduated (Item No. 4142000). Three syringes, Luer, 1 ml., graduated (Item No. 3843000). Six needles, No. 20 or 22, for Luer syringe (Item No. 3850500 and No. 3850300), sterile, in Wassermann tubes, 100 by 13 mm. (Item No. 4439000), with cotton plugs. One bottle, amber, with glass or rubber stopper, 250 ml., e.g., empty acid bottle, containing sulfonamide reagent. One bottle, wide mouth, 60 ml. (Item No. 4056600) for alcohol sponges. Three rubber stoppers, solid, No. 1 (Item No. 4414000). Kit, wood, with cover, to contain above equipment with removable 6-hole comparator block. Additional equipment,

such as a tourniquet and an electric or hand centrifuge, is available at most field medical installations and is not included as part of the kit.

Procedure for Unknowns

Measure out 9 ml. of the sulfonamide reagent into a 15-ml. graduated centrifuge tube. Draw about 1 ml. of venous blood from the patient into a 1-ml. graduated syringe and measure out exactly 0.5 ml. into the centrifuge tube containing the sulfonamide reagent. Work rapidly to prevent the blood from clotting. Insert a rubber stopper into the tube and shake vigorously for one minute. Leave the rubber stopper in the tube and centrifuge above 2,000 r.p.m. for five minutes. Pour off the supernatant fluid into a Loeffler tube and add 10 drops of the N hydrochloric acid. Invert several times, wait five minutes, and compare against known standards in the comparator block estimating the nearest milligram percent.

Discussion

Where a centrifuge is not available, the alcohol-ether extract of the sulfonamide may be filtered off into another centrifuge tube and the precipitate washed with the sulfonamide reagent until the filtrate reaches a total volume of 9 ml.

TABLE I

Comparison of new procedure with Bratton-Marshall method for sulfadiazine

Specimen No.	New procedure sulfadiazine	Photometric Bratton-Marshall method sulfadiazine
0 to 4 mg. % range	Mg. %	Mg. %
1	1.0	1.0
2	1.0	1.1
3	1.0	1.4
4	1.5	1.7
5	1.5	2.0
6	2.0	1.7
7	3.0	2.0
8	3.0	2.3
9	3.5	2.5
10	4.0	2.5
11	4.0	2.8
12	4.0	3.7
13	4.0	3.8
Average value	2.6	2.2

A large number of determinations have been run by this procedure as compared with those obtained by the Bratton and Marshall method, using a photoelectric colorimeter, with excellent results. A few of these results are given in table I. The method fails to give reliable results only in those cases where the patient has a very high blood urea. Of the other sulfonamides which may be determined by this procedure, sulfapyridine and sulfathiazole give about the same amount of color as does sulfadiazine and the same set of standards may be used in their determination. For accurate sulfanilamide results, the values obtained by this procedure should be divided by 1.5.

Summary

This is a simple, rapid method for the determination of blood sulfonamides, using an alcohol-ether solution of p-dimethylamidobenzaldehyde to precipitate the proteins and simultaneously extract the sulfonamides.

Interference from proteins is eliminated by the addition of the acid necessary for the color development *after* the removal of the proteins, and the color due to normal amounts of urea is compensated for by the use of standards prepared from known amounts of sulfadiazine dissolved in whole blood. The method is sufficiently accurate for use in the field without requiring any elaborate equipment.

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